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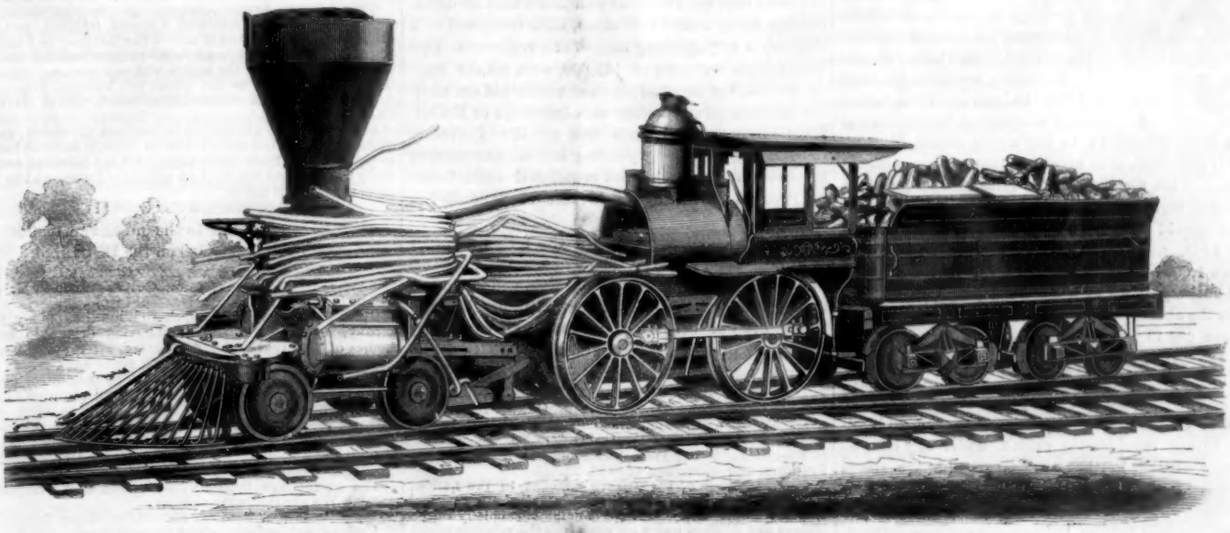
Remarkable Locomotive Boiler Explosion.

The accompanying illustration of an exploded locomotive boiler has been prepared by us from a photograph sent by our correspondent whose graphic account is given in the annexed letter.

MESSRS. EDITORS :—Inclosed with this letter I send you a photograph of a locomotive which exploded her boiler on the 14th of July last. She was one of the Cleveland and Toledo Railroad Company's heavy freight engines, and had but a short time before been thoroughly repaired and smaller driving wheels put under. No cause has been assigned for the accident. She had just started from this station and had not gone 80 rods from the Company's round house when she exploded. She appears to have give way on the top of her boiler first as she did not go off the track and the rails were bent down almost square when the explosion took place. Every one who saw the engine said that she was the most complete wreck they ever saw. All that was left of her that could be used were the cylinders, frame and driving wheels, and they were badly injured.

The most singular part of the accident is, no one was injured by the terrible explosion, although there was another engine attached to the one that exploded, assisting it up the grade. The engineer—Mr. Levi Kingsbury—says the first thing he knew was that himself and the fireman were on one side of the track trying to find out what had happened. The engine and train ran about 20 rods after the explosion. She was a Rogers, Paterson, engine and about six years old. Some of the engineers will have it that it was on account of changing her name, which was done a short time previous, and it is a singular fact that the names of five locomotives have been changed on this road and every one of them had some serious accident happen almost immediately after. Three were blown up and two ran off of the track killing some person every time excepting on the late occasion. The photograph is a curiosity and will be prized. W. S. HADLEY.

Norwalk, Huron Co., Ohio, Sept. 28, 1862.



EXPLODED LOCOMOTIVE BOILER.

The appearance of the exploded locomotive represented in the annexed engraving is such that it conveys the idea that no mysterious agent was the cause of the accident, but simply an overpressure of steam. As there are still many persons who believe that explosions in boilers sometimes occur by the water being decomposed and resolved into its elementary gases—oxygen and hydrogen—by the plates of the metal becoming red-hot, we have now testimony of the highest scientific value against this hypothesis. This testimony has been published in a recent number of the London *Chemical News*, from which we make the following extracts and commend them for their scientific importance to every person who has anything to do with steam boilers :—

The unsatisfactory results generally obtained by those who have sought to decompose water by heat on a large scale, with the view of applying its elementary gases separately, does not appear to have prevented the occasional adoption of the hypothesis that, in certain cases, all the steam contained within a boiler is decomposed, and its hydrogen (by some means not easily explained) exploded with great violence. That steam, passed over pure metallic iron heated to redness, is decomposed, is perfectly true, although the iron must retain all the oxygen separated in the operation. With oxidized iron, however, the process of decomposition cannot be continued. This is, we believe, a chemical fact of which there can be no dispute. To decompose 1 pound of water (or steam, which is chemically the same substance) 14·2 ounces of oxygen must be fixed by the iron, and only 1·8 ounces of hydrogen will be set free. This large proportion of oxygen, absorbed by only a few square feet of over-heated surfaces, would soon form an oxide of iron of sufficient thickness to arrest all further decomposition, and all the hydrogen up to that time disengaged would not amount, perhaps, to 1 pound in weight. By itself or mixed with steam, hydrogen cannot be exploded nor even ignited. It will extinguish flame as effectually as would water.

Upon this subject we may refer to a report made by Professor Faraday in May, 1859, to the Board of Trade, upon the liability to accident consequent upon the introduction of an apparatus for superheating steam on board the Woolwich steamboats. In this apparatus the steam was carried in iron pipes immediately through the furnace, and in contact with the incandescent fuel. Professor Faraday, after having examined the apparatus at work, says :—

"I am of opinion that all is safe : as respects the decomposition of the steam by the heated iron of the tube and the separation of hydrogen no now danger is incurred. Under extreme circumstances the hydrogen which could be evolved would be very small in quantity—would not exert greater expansive force than the steam—would not with steam form an explosive mixture—would not be able to burn with explosion, and probably not at all if it, with the steam, escaped through an aperture into the air or even into the fireplace. Supposing the tubes were frequently heated overmuch a slow oxidation of the iron might continue to go on within ; this would be accompanied by a more rapid oxidation of the exterior iron surface, and the two causes would combine to the gradual injury of the tube. But that would be an effect coming under the cognizance of the engineer, and would require repair in the ordinary manner. I do not consider even this action likely to occur in any serious degree. I examined a tube which had been used many months, which did not show the effect, and no harm or danger to the public could happen from such a cause."

Professor Taylor, of Guy's Hospital, reported in part as follows :—

"It is true that steam passed over pure metallic iron heated to redness (1000°) is so decomposed that the oxygen is fixed by the iron while hydrogen gas is liberated. This chemical action, however, is of a very limited kind. The surface of the iron is rapidly covered with a fixed and impermeable layer of the magnetic oxide of iron, and thenceforth the chemical action is completely arrested. If the interior of an iron pipe has been already oxidized, by passing through it, while in a heated state, a current of air, there will be no decomposition of steam during its passage through it. If the interior of an iron

pipe were not thus previously oxidized it would speedily become so by the oxygen derived from the air, which is always mixed with steam. Hence, chemically speaking, under no circumstances, in my opinion, would any danger attend the process of superheating steam as it is conducted under this patent. It is proper, also, to state that hydrogen is not explosive but simply combustible, and, assuming that it was liberated as a result of the decomposition of superheated steam, its property of combustibility would not be manifested in the midst of the enormous quantity of aqueous vapor liberated with it and condensed around it. There could be no explosion inasmuch as hydrogen, unless previously mixed with oxygen, does not explode, and oxygen is not liberated but actually fixed by the iron in this process. It is a demonstrable fact that the vapor and gas evolved under the form of superheated steam tend to extinguish flame and to prevent combustion from any other cause."

Professor Brande, in a report made by him to the patentees of the same apparatus, observes :—

"In reference to the question which you have submitted to me respecting the possible or probable evolution of hydrogen gas, and consequent risk of explosion in the processes, and by means of the apparatus which you employ for the production of superheated steam, I am of opinion that there can be no danger from such effect—that the temperature to which the iron pipes connected with your boiler are raised, and the extent of the iron surface over which the steam passes, are insufficient for its decomposition ; and that, if the temperature of the pipes were even raised considerably beyond that which you employ, or would be able to attain, a superficial layer of oxide of iron would line the interior of the heated pipes, and so prevent any continuous decomposition of water. Effectually to decompose steam, by passing it over iron, it is necessary that a very extended surface of the metal (as in the form of thin plates or iron turnings) should be used, and that the temperature should be continuously maintained at a bright red heat, namely, at a temperature considerably above 1,000° Fah. I have read Dr. Taylor's report, and entirely agree with the inferences he has drawn as to the absence of danger from the evolution of hydrogen gas in practically carrying out your process for the production and application of superheated steam."

The practical conclusions upon this subject are the following :—First, decomposition cannot possibly occur, to any considerable extent, under any circumstances arising in the working of ordinary steam boilers. Second, if it did occur the hydrogen thus liberated would have no access to oxygen, without which it could neither inflame nor explode. Third, even if oxygen were present the presence of steam would prevent ignition. Fourth, if oxygen were present, and no steam existed in the boiler, the hydrogen would only inflame and burn silently as fast as it was produced, the heat for ignition being supposed to come from a red-hot plate. Under these accumulated impossibilities of violent explosive action, the explanation of boiler explosions by the decomposition of steam is without any support whatever.

IMPROVEMENTS IN THE ART OF HOUSEKEEPING.—It is sometimes said that there are less improvements in the art of housekeeping than any other. It is quite clear that there are not enough of them, and those which are made are not generally adopted. Let us refer now to what we regard as an improvement in the little art of shelling beans. The old method was making use of the thumb and fingers ; then the use of a needle to prepare the pod to open readily. Now, the method is to pour upon the pods a quantity of scalding water and the beans slip very easily from the pod. By pouring scalding water on apples, the skin may be easily slipped off, and much labor saved.

TAXATION IN DIXIE.—The new revenue bill before the rebel Congress provides for the levying on the 1st of January next, a tax of one-fifth the value of the products of the land for the preceding year ; one-fifth the value of the increase of horses, asses, cattle, sheep and swine ; one-fifth the products made in feeding the same ; and one-fifth the yearly income of each person. The rebels will pay dearly for their whistle.

NOTES ON NAVAL AND MILITARY AFFAIRS.

AFFAIRS IN NEW ORLEANS.

General Butler has so far succeeded in restoring order in New Orleans that he has reöpened the courts and reëstablished civil law. He is receiving many volunteers too for the Union army.

AFFAIRS IN NORTH CAROLINA.

The Hon. C. H. Foster is running as the Administration candidate for the United States Congress. He is addressing Union war meetings in the eastern counties of the State in favor of filling up the North Carolina regiments, and it is said that he is meeting with good success.

The Unionists in Camden county have petitioned President Lincoln for permission to drive all the rebel families out of the county. If granted, they promise two loyal regiments for the Union, half of which are already raised—one of cavalry and one of infantry.

It is stated that Gov. Vance, who was recently elected by the party least hostile to the North, has called a council of the leading men of the State to take President Lincoln's proclamation into consideration.

AFFAIRS ON THE POTOMAC.

On the 4th of October, President Lincoln reviewed the army of General McClellan, which is situated in the neighborhood of Harper's Ferry, very near the scene of the great battle of Antietam, or Sharpsburg. It is said that the President rode more than 40 miles, passing by at least 12 divisions, each composed of 3 brigades, a brigade being formed of 4 regiments. This would make an army of 144,000, were all the regiments full, but many of the old regiments are terribly thinned. Besides these are other corps of McClellan's army on the south side of the Potomac. General Sigel is slowly pushing his reconnoissances southwest along the railroad route, over which General Pope was driven by the advance of Generals Lee and Jackson.

General McClellan has issued the following order with reference to the President's emancipation proclamation. As long as these sentiments prevail among our soldiers as well as our citizens, the overthrow of our beneficent institutions by military power—so persistently prophesied by mocking foreigners—can never take place :—

HEADQUARTERS, ARMY OF THE POTOMAC,
CAMP NEAR SHARPSBURG, Md., Oct., 7, 1862.

The attention of the officers and soldiers of the Army of the Potomac is called to General Orders No. 139, War Department, Sept. 24, 1862, publishing to the army the President's proclamation of Sept. 22.

A proclamation of such grave moment to the nation, officially communicated to the army, affords to the general commanding an opportunity of defining specifically to the officers and soldiers under his command the relation borne by all persons in the military service of the United States toward the civil authorities of the government. The constitution confides to the civil authorities, legislative judicial and executive, the power and duty of making, expounding and executing the Federal laws. Armed forces are raised and supported simply to sustain the civil authorities, and are to be held in strict subordination thereto in all respects. This fundamental rule of our political system is essential to the security of our republican institutions, and should be thoroughly understood and observed by every soldier. The principle upon which, and the objects for which, armies shall be employed in suppressing the rebellion, must be determined and declared by the civil authorities, and the chief Executive, who is charged with the administration of the national affairs, is the proper and only source through which the views and orders of the Government can be made known to the armies of the nation.

Discussion by officers and soldiers concerning public measures determined upon and declared by the Government, when carried at all beyond the ordinary temperate and respectful expression of opinion, tend greatly to impair and destroy the discipline and efficiency of troops by substituting the spirit of political faction for that firm, steady and earnest support of the authority of the Government which is the highest duty of the American soldier. The remedy for political errors, if any are committed, is to be found only in the action of the people at the polls.

In thus calling the attention of this army to the true relation between the soldiers and the Government, the general commanding merely adverts to an evil against which it has been thought advisable during our whole history to guard the armies of the republic, and in so doing he will not be considered by any right-minded person as casting any reflection upon that loyalty and good conduct which has been so fully illustrated upon so many battle fields. In carrying out all measures of public policy this army will, of course, be guided by the same rules of mercy and Christianity that have ever controlled its conduct toward the defenceless.

AFFAIRS IN KENTUCKY.

The attention of the country is now directed to the great operations in Kentucky. On the 1st of October, General Buell's army started from Louisville to the south, in the direction of Bardstown. On the 4th, the rebels at Frankfort, the capital of the State, which is 65 miles by railroad nearly due east from Louisville, went through the farce of inaugurating Richard Howes as Governor of Kentucky, and the next day they abandoned the place ; probably fearing that General Buell would get in their rear.

REBEL ATTACK ON CORINTH.

After the battle of Iuka it seems that General Rosecrans retired with his forces behind the entrenchments of Corinth, where he was assailed on Saturday, the 4th of October, by the main rebel army. General Grant's headquarters are at Jackson, some 60 miles north of Corinth, and from that point he has forwarded the three following despatches :—

GRANT'S HEADQUARTERS, JACKSON, Tenn., Oct. 5—8 A. M.

To Major General H. W. Halleck, General-in-Chief, United States Army :—

Yesterday the rebels, under Price, Van Dorn and Lovell, were repulsed from their attack on Corinth with great slaughter. The enemy are in full retreat, leaving their dead and wounded on the field. Rosecrans telegraphs that the loss is serious on our side, particularly in officers, but bears no comparison with that of the enemy. General Hackleman fell while gallantly leading his brigade. General Oglesby is dangerously wounded. General McPherson, with his command, reached Corinth yesterday.

General Rosecrans pursued the retreating enemy this morning, and, should they attempt to move toward Bolivar, will follow to that place. General Hurlbut is at the Hatchie river with five or six thousand men, and is no doubt with the pursuing column. From seven hundred to a thousand prisoners, besides the wounded, are left in our hands. U. S. GRANT, Major General Commanding.

GRANT'S HEADQUARTER'S, JACKSON, Tenn., Oct. 5. 1862

To Major General H. W. Halleck, General-in-Chief United States Army :—

General Ord, who followed General Hurlbut, met the enemy to-day on the south side of the Hatchie, as I understand from a despatch, and drove them across the stream and got possession of the hights with our troops. General Ord took two batteries and about two hundred prisoners. A large portion of General Rosecrans's forces were at Chevalla.

At this distance everything looks most favorable, and I cannot see how the enemy are to escape without losing everything but their small arms. I have strained everything to take into the fight an adequate force, and to get them to the right place.

U. S. GRANT, Major General Commanding.

Chevalla is ten miles to the northwest of Corinth on the railroad to Memphis on the Mississippi.

HEADQUARTERS OF GENERAL GRANT, JACKSON, Tenn., Oct. 6—12 : 20 P. M.

To Major-General Halleck, General-in-Chief :—

Generals Ord and Hurlbut, came upon the enemy yesterday, and General Hurlburt having driven in small bodies of the rebels the day before, after seven hours' hard fighting drove the enemy five miles back across the Hatchie toward Corinth, capturing two batteries, about three hundred prisoners, and many small arms. I immediately apprised General Rosecrans of these facts, and directed him to urge on the good work. The following despatch has just been received from him :—

CHEVALLA, Oct. 6, 1862.

To Major-General Grant :—

The enemy are totally routed, throwing everything away. We are following sharply.

W. S. ROSECRANS, Major General.

Under previous instructions General Hurlbut is also following. General McPherson is in the lead of General Rosecrans's column. The rebel General Martin is said to be killed.

U. S. GRANT, Major General Commanding.

Engraving by Electricity.

Some will have noticed the machine in class VII. for engraving the cylinders, of copper brass, employed in the printing of woven fabrics and paper hangings. Its distinctive feature is in the application of voltaic electricity in communicating certain necessary movements to important and delicate portions of the apparatus. The cylinder to be engraved is first coated on its outer surface with a thin film of varnish, sufficiently resistant to the continuous action of the strongest acids. The requisite number of copies of the orignal design are then traced or scratched simultaneously by a series of diamond points, which are arranged on the machine parallel, with the axis of the cylinder. Each diamond point is in correspondence with a small temporary magnet ; and the entire series is so arranged *en rapport* with the original design, which had been previously etched on a metal cylinder fitted in with a non-conducting substance (this cylinder being made to revolve in contact with a tracing point), that when the electric current passes, intermittent currents are established, whereby the diamonds are withdrawn from their work at the proper intervals. The metallic surface is thereby exposed in certain parts ; and a bath of nitric or other acid being afterward used to etch or deepen the engraved portion, the operation is completed. By means of this apparatus, engravings may be enlarged or diminished to any necessary extent from the same original.—*London Builder.*

SPECIFICATION OF AN ANCIENT PATENT.

In looking over the admirable digest of English Patents, now in course of publication under the supervision of B. Woodcroft, Esq., we are often amused at the attempts made by early inventors to describe their discoveries. We copy the following curious specimen as an example, not doubting that our readers will enjoy its perusal. We also preserve the peculiar orthography that was standard two hundred years ago. The patent was granted to Sir John Christopher Van Berg, April 27, 1636, and is classed by Mr. Woodcroft among the patents granted for shipbuilding. This invention, says Sir John, consists in "diverse mechanicke instruments and frames operating by waights soe to bee fitted and ordered that the force and strength of them may bee augmented or diminished either in regard of the instruments themselves or in respecte of the number of workemen to bee ymployed aboute them accordinge as occasion or necessitie shall require—Which instrumts or frames may bee exercised by land either belowe on the ground or on highe alofte as well within as without any building And likewise by water in shipps pontes boates and shallopps for the effectinge any such thinge or things as may neede lifting or heaving vpp letting or drawing or halinge from place to place transporting forcible strikeing in pullinge forth bearinge downe battering pressing plateinge or squeesing by the vse of them alsoe all manner of thinges maye bee waighed moste conveniently. An invencon whereby the smythes bellowes may bee made to blowe without putting to any hand either to houlde or drawe them. "Diverse engynes for waterworkes whereby the water may bee compelled to rise that soe itt may bee the better deduced from place to place and naturall streames or currents may be turned or diverted att pleasure likewise divers mills to bee turned or agitated by runnyng rivers or other waters by winde waights beasts as horses oxen and the like or by hande serving for the doing whatsoever things may need to bee grinded beaten brused grated pestled hamered cutt hewen hackt sawed whetted playned with tooles turned winded rowled circulated caste forthe or evacuated. Alsoe instruments partly mathematicall partly mechanicall serving for the accurate measuring of land or ground and may alsoe in a certayne manner bee ymployed to coaches carts waggons or any other thinge that is moved from place to place thereby to knowe the exact distance and dispatch of theire mocon likewise instruments of sounding and fathoming of any depthes whither of waters or mynes or any other depth as alsoe to knowe any heighte above the ground. Alsoe invencons of all kinde of wagons waynes coaches cartes litters wheelbarrows packsaddles and side saddles better for ease advantage and proffitt than hitherto have beene vsed other instruments whereby any shipp receaving a leake may bee pserved from sinkeinge till ytt may bee brought to shore to bee amended or in case such shipp of necessitie must sincke then whereby a signe may bee extant above the water to shewe the place where it suncke that soe instruments may bee applyed for the draweinge itt vpp againe With an assured way howe the very greateste shipp may bee drawne vpon agayne thoughe itt bee suncke eightie fathomes deepe Also instruments for the advantagious removeinge or takeing forth sand or earth out of shallowe places" "either att sea or in ryvers" "Likewise an engyne to go contynually by water horse or man for the workeinge all sortes of tymber as well great for carpenters as small for joyners and the same to drive diverse frames att once each frame takeinge in itts owne worke and delivering itt out agayne without interrupting other Alsoe another invencon very good for warminge the bodie of man and for boyling roasting or fryeinge all kinds of meats" &c.

Another invencon to bee agitated by winde water or horses for the cleane threshing of corne" "Alsoe a new kinde of washe or laundrie howse" "Lastly another invencon especially vsefull in and aboute the building and repayreing of churches and greate edifices howses shipps and the like for the better saveinge the excessive charge hee hath hearde is expended in scaffolds in and about the same."

The Ohio river is so low in most places above Wheeling, that it can be crossed on foot by man and beast for a distance of nearly a hundred miles.

Depths of Mines in England.

An English journal, after valuing the total product of the mines of Great Britain at £41,491,102 per annum, and computing that England's supply of coal will last at least seven hundred years longer, at present rates of consumption, gives the following account of the depth to which the bowels of the earth have been pierced in England :—

The depth to which we mine for coal is already great. The pit at Duckenfield, in Chesshire, is 2,004 feet below the surface to the point where it intersects the "Black Mine Coal," a seam which is four feet six inches thick, and of the best quality for domestic and manufacturing purposes; from this point a further depth of 500 feet has been attained by means of an engine plane in the bed of coal, so that a great portion of the coal is now raised from the enormous depth of 2,504 feet. At Pendleton, near Manchester, coal is daily worked from a depth of 2,125 feet; and the cannel coal of Wigan is brought from 1,773 feet below the surface. Many of the Durham collieries are equally deep, and far more extended in their subterranean labyrinths. Some of those, and others in Cumberland, are worked out far under the bed of the sea; and on both sides of the island we are rapidly extending our subterranean burrowing.

Dolcoath tin mine, in Cornwall, is now working at one thousand eight hundred feet from the surface, and is rapidly sinking deeper. The depth of Tresavean, a copper mine, is 2,180 feet. Many other tin and copper mines are approaching these depths; and under the Atlantic waves, in Botallack, Levant and other mines, man is pursuing his labors daily at half a mile from the shore. To aid the miner in these severe tasks, gigantic steam engines, with cylinders 100 inches in diameter, are employed in pumping water from these vast depths. Winding engines, which are masterpieces of mechanical skill, are even at work raising the minerals from each dark abyss, and "man engines," of considerable ingenuity—so-called because they bring the wearied miners to the light of day, saving him from the toil of climbing up perpendicular ladders—are introduced in many of our mose perfectly conducted mines. Our coals cost us annually 1,000 lives, and more than double that number of our metalliferous miners perish from accidents in the mines, or at an unusually early age—thirty-two—from diseases contracted by the conditions of their toils. By the industry of our mining population there is annually added to our national wealth considerably more than £30,000,000. This, when elaborated by the process of manufacture, is increased in value tenfold. While we are thus drawing upon that "hoarded treasure, guarded by dragons white and red," which the enchanter Merlin is fabled to have concealed in the caves of the earth, we should not cease to remember how much of mental labor and muscular power is expended, and bow large a percentage of human life is annually sacrificed in the contest with those hydra-headed evils which are truly personified by the dragons of the legend.

Iron Formed by Animalcules.

The *Journal de l'Instruction Publique* contains a curious article by M. Oscar de Watterville, in which he announces the fact, not generally known, that in the lakes of Sweden there are vast layers or banks of iron, exclusively built up by animalcules, not unlike those that have laid the foundations of large islands in the ocean, by silently and for ages cementing matter with matter, so as to create those beautiful forms known as madre-poræ, mille-poræ, corals, &c. The iron thus found is called in Sweeden "lake ore," distinguished, according to its form, into gunpowder, pearl, money, or cake ore. These iron banks are from 10 to 200 mètres in length, from 5 to 15 broad, and from a fourth to three-fourths of a mètre and more in thickness. In winter the Swedish peasant, who has but little to do in that season, makes holes in the ice of a lake, and with a long pole probes the bottom, until he has found an iron bank. An iron sieve is then let down, and with a sort of ladle, conveniently fashioned for the purpose, the loose ore is shoveled into the sieve, which is then hoisted up again. The ore thus extracted is of course mixed with a quantity of sand and other extraneous matter, which is got rid of by washing it in a cradle like that used by gold diggers. A man may get out a tun of iron ore per day by this process.

Government Contracts for Cannon.

A rare specimen of rich satirical humor will be observed in the following extracts from a letter of O. C. Kerr, Esq. :—

By invitation of a well-known official, I visited the Navy Yard yesterday, and witnessed the trial of some newly-invented rifled cannon. The trial was of short duration, and the jury brought in a verdict of innocent of any intent to kill.

The first gun tried was similar to those used in the Revolution, except that it had a large touchhole, and the carriage was painted green, instead of blue. This novel and ingenious weapon was pointed at a target about sixty yards distant. It didn't hit it, and, as nobody saw any ball, there was much perplexity expressed. A midshipman did say that he thought the ball must have run out of the touchhole when they loaded up—for which he was instantly expelled from the service. After a long search without finding the ball, there was some thought of summoning the Naval Retiring Board to decide on the matter, when somebody happened to look into the mouth of the cannon, and discovered that the ball hadn't gone out at all. The inventor said this would happen sometimes, especially if you didn't put a brick over the touchhole when you fired the gun. The Government was so pleased with this explanation, that it ordered forty guns on the spot, at two hundred thousand dollars apiece. The guns to be furnished as soon as the war is over.

The next weapon tried was Jink's double back action revolving cannon for ferry boats. It consists of a heavy bronze tube, revolving on a pivot, with both ends open, and a touchhole in the middle. While one gunner puts a load in at one end, another puts in a load at the other end, one touchhole serving for both. Upon applying the match, the gun is whirled swiftly round on a pivot, and both balls fly out in circles, causing great slaughter on both sides. This terrible engine was aimed at the target with great accuracy; but as the gunner has a large family dependent on him for support, he refused to apply the match. The Government was satisfied without firing, and ordered six of the guns at a million of dollars apiece. The guns to be furnished in time for our next war.

The last weapon subjected to trial was a mountain howitzer of a new pattern. The inventor explaned that its great advantage was, that it required no powder. In battle it is placed on the top of a high mountain, and a ball slipped loosely into it. As the enemy passes the foot of the mountain, the gunner in charge tips over the howitzer, and the ball rolls down the side of the mountain into the midst of the doomed foe. The range of this terrible weapon depends greatly on the hight of the mountain and the distance to its base. The Government ordered forty of these mountain howitzers at a hundred thousand dollars apiece, to be planted on the first mountains discovered in the enemy's country.

These are great times for gunsmiths, my boy; and if you find any old cannon around the junk shops, just send them along. O. C. Kerr.

Machinery Useful in Making Shoes.

Making shoes by machinery is getting to be quite an institution in these parts. There are several manufacturers who are about putting in the pegging and sewing machines both by hand and steam power. This will have the effect of concentrating the business, and insure a stock of shoes to the manufacturer in a short space of time. Good workmen should combine together and run a machine on their own account. The workmen will be left entirely in the shade unless they form gangs and work by machinery. The car of progress is moving forward, and the laborer must keep up. It would not be at all surprising to us if there were twenty machines of both kinds at work in this place in less than a year. No war can stop New England enterprise.—*Essex (Mass.) Banner.*

Defects of the Frigate Ironsides.—We have received information, which appears to be perfectly reliable, respecting the defects of the *Ironsides*, as a sea going vessel. It is said that she rolls heavily in a very light sea, and to use a nautical term, "she is very wet." "The engines, however, work very well." She is now off Newport News, watching for *Merrimac* No. 2.

THE PROPERTIES OF IRON AND ITS RESISTANCE TO PROJECTILES AT HIGH VELOCITIES.

BY WILLIAM FAIRBAIRN, ESQ., F.R.S.

We have no correct record as to the exact time when wrought-iron plates were first employed for the purpose of building vessels. It is, however, certain that iron barges were in use on canals at the close of the last century. In 1824 Mr. Manley, of Staffordshire, built an iron steamboat for the navigation of the river Seine, and this was the first iron vessel that attempted a sea voyage. She was navigated from this country to Havre, by the late Admiral Sir Charles Napier, and although constructed for shallow rivers, she nevertheless crossed the channel in perfect safety. From that time to 1830 no attempt was made to build iron vessels, and nothing was done toward ascertaining the properties of iron as a material for shipbuilding.

A series of experiments instituted by the Forth and Clyde Canal Company in 1829-30, to ascertain the law of traction of light boats at high velocities on canals, led to the application of iron for the construction of vessels, and the lightness of these new vessels, combined with their increased strength, suggested the extended application of the material in the construction of vessels of much larger dimensions, and ultimately to those of the largest class both in the war and the mercantile navy. Considerable difficulty, however, existed with regard to the navy; and although the principle of iron construction as applied to merchant vessels and packets was fully established, it was nevertheless considered inapplicable, until of late years, for ships of war. It is true that until the new system of casting the sides of vessels, first introduced by the Emperor of the French in 1854, was established, the iron ship was even more dangerous under fire than one built entirely of wood. Now, however, that thick iron plates are found sufficiently strong, under ordinary circumstances, to resist the action of guns, not exceeding 120-pounders, for a considerable length of time, the state of the navy and the minds of our naval officers have entirely changed. We must, therefore, now look to new conditions, new materials, and an entirely new construction, if we are to retain our superiority as mistress of the seas. There yet remain amongst us those who contend for the wooden walls, but they are no longer applicable to the wants of the State; and I am clearly of opinion that we cannot afford to trifle with so important a branch of the public service as to fall behind any nation, however powerful and efficient they may be in naval construction. Having satisfied ourselves that this desideratum must be attained, at whatever cost, I shall now endeavor to point out such facts as, in my opinion, relate to the changes that are now before us, and simply endeavor to show—

1st. The description of iron best calculated to secure strength and durability in the construction of ships of war.

2d. The distribution and best forms of construction to attain this object.

3d. The properties of iron best calculated to resist the penetration of shot at high velocities.

PROPERTIES OF IRON.

If we are desirous to attain perfection in mechanical, architectural, or shipbuilding construction, it is essential that the engineer or architect should make himself thoroughly acquainted with the properties of the materials which he employs. It is unimportant whether the construction be a house, a ship, or a bridge. We must possess correct ideas of the strength, proportion, and combination of the parts, before we can arrive at satisfactory results: and to effect these objects the naval architect should be conversent with the following facts relating to the resisting powers of malleable and rolled iron to a tensile strain.

The resistance in tuns per square inch of—

Yorkshire Iron is	24·50 tuns.
Derbyshire "	20·25 "
Shropshire "	22·50 "
Staffordshire "	20·00 "

STRENGTH OF RIVETED JOINTS.

The architect having fortified himself with the above facts, will be better able to carry out a judicious distribution of the frames, ribs, and plates of an iron ship, so as to meet the various strains to which it may be subjected, and ultimately to arrive at a distribution where the whole in combination presents uniformity of resistance to repeated strains, and the various changes it has to encounter in actual service.

There is, however, another circumstance of deep importance to the naval architect, which should on no account be lost sight of, and that is, the comparative values of the riveted joints of plates to the plates themselves. These, according to experiment, give the following results:—

Taking the cohesive strength of the plate at	100
The strength of the double-riveted joint was	70
And the single-riveted joint	56

These proportions apply with great force to vessels requiring close riveting, such as ships and boilers that must be water-tight, and in calculation it is necessary to make allowance in that ratio.

STRENGTH OF SHIPS.

Of late years it has been found convenient to increase the length of steamers and sailing vessels to as much as eight or nine times their breadth of beam, and this for two reasons; first, to obtain an increase of speed by giving fine sharp lines to the bow and stern; and second, to secure an increase of capacity for the same midship section, by which the carrying powers of the ship are greatly augmented. Now, there is no serious objection to this increase of length, which may or may not have reached the maximum. But, unfortunately, it has hitherto been accomplished at a great sacrifice to the strength of the ship. Vessels floating on water and subjected to the swell of a rolling sea—to say nothing of their being stranded or beaten upon the rocks or sand banks of a lee shore—are governed by the same laws of transverse strains as simple hollow beams, like the tubes of the Conway and Britannia tubular bridges. Assuming this to be true, and indeed it scarcely requires demonstration, it follows that we cannot lengthen a ship with impunity without adding to her depth or to the sectional area of the plates in the middle along the line of the upper deck.

If we take a vessel of the ordinary construction, or what some years ago was considered the best—300 feet long, 41 feet 6 inches beam, and 26 feet 6 inches deep—we shall be able to show how inadequately she is designed to resist the strains to which she would be subjected. To arrive at these facts we shall approximate nearly to the truth by treating it as a simple beam; and this is actually the case, to some extent, when a vessel is supported at each end by two waves, or when rising on the crest of another, supported at the center with the stem and stern partially suspended. Now in these positions the ship undergoes, alternately, a strain of compression and of tension along the whole section of the deck, corresponding with equal strains of tension and compression along the section of the keel, the strains being reversed according as the vessel is supported at the ends or the center. These are, in fact, the alternate strains to which every long vessel is exposed, particularly in seas where the distance between the crests of the waves does not exceed the length of the ship.

It is true that a vessel may continue for a number of voyages to resist the continuous strains to which she is subjected while resting on water. But supposing in stress of weather, or from some other cause, she is driven on rocks, with her bow and stern suspended, the probability is that she would break in two, separating from the insufficiency of the deck on the one hand, and the weakness of the hull on the other. This is the great source of weakness in wrought-iron vessels of this construction, as well as of wooden ones, when placed in similar trying circumstances.

CHANGES IN PROGRESS.

Having directed attention to the strength of ships, and the necessity for their improved construction, we may now advert to the changes by which we are surrounded and to the revolution now pending over the destinies of the navy, and the deadly weapons now forging for its destruction, it is not for us alone, but for all other maritime nations, that these Cyclopean monsters are now issuing from the furnaces of Vulcan; and it behoves all those exposed to such merciless enemies to be upon their guard, and to have their *Warriors*, *Merrimacs* and *Monitors*, ever ready, clothed in mail from stem to stern to encounter such formidable foes. It has been seen, and every experiment exemplifies the same fact, that the iron ship with its coat of armor is a totally different construction to that of the wooden walls which for centuries have been the pride and glory of the country. Three deckers, like the *Victory* and the *Ville de Paris* of the last century, would not exist an hour against the sea monsters now coming into use.

The days of our wooden walls are therefore gone; and instead of the gallant bearing of a 100-gun ship, with every inch of canvas set, dashing the spray from her bows and careering merrily over the ocean, we shall find in its place a black demon, some five or six hundred feet long, stealing along with a black funnel and flag staff, on her mission of destruction, and scarcely seen above water, excepting only to show a row of teeth on each side, as formidable as the immense iron carcass that is floating below. This may, with our present impressions, be considered a perspective of the future navy of England—probably not encouraging—but one on which the security of the country may ultimately have to depend, and to the construction of which the whole power and skill of the nation should be directed. I have noticed these changes, which are fast approaching, from the conviction that the progress of the applied sciences is not only revolutionizing our habits in the development of naval constructions, as in every other branch of industry, but the art of war is undergoing the same changes as those which have done so much for the industrial resources of the country in times of peace. It is therefore necessary to prepare for the changes now in progress, and endeavor to effect them on principles calculated not noly to insure security, but to place this country at the head of constructive art. It is to attain these objects that a long and laborious class of experiments have been undertaken by the Government, to determine how the future navy of England shall be built; how it should be armed, and under what conditions it can best maintain the supremacy of the seas. This question does not exclusively confine itself to armor-plated vessels, but also to the construction of ships which, in every case, should be strong and powerful enough to contend against either winds and waves or to battle with the enemy. It is for these reasons that I have ventured to direct attention to the strength of vessels, and to show that some of our mercantile ships are exceedingly weak, arising probably from causes of a mistaken economy on the one hand, or a deficiency of knowledge or neglect of first principles on the other.

Now it is evident that our future ships of war of the first class must be long and shallow; moreover they must contain elements of strength and powers of resistance that do not enter into the construction of vessels that are shorter and nearly double the depth. If we take a first-rate ship of the present construction, such as the *Duke of Wellington*, and compare it with one of the new or forthcoming constructions carrying the same weight of ordnance, we should require a vessel nearly twice the length and little more than half her depth. Let us, for example, suppose the *Duke of Wellington* to be 340 feet long and 60 feet deep, and the new construction 500 feet long and 46 feet deep; we should then have for the resistance of the *Duke of Wellington* to a transverse strain tending to break her back,

$$W = \frac{a\,d\,c}{l}$$

Taking 60 as the constant, and the area of the bottom and upper deck as 1060 square inches, we have

$$W = \frac{1060 \times 60 \times 60}{340} = 11{,}223 \text{ tuns},$$

as the weight that would break her in the middle. Let us now take the new ship, and give her the same area top and bottom, and again we have

$$W = \frac{1060 \times 46 \times 60}{500} = 5{,}851 \text{ tuns},$$

which is a little more than half the strength. From this it is obvious—if we are correct in our calculations—that the utmost care and attention is requisite in design and construction to insure stability and perfect security in the build of ships.

MECHANICAL PROPERTIES OF IRON.

It is unnecessary to give more examples in regard to strength, and the proportions that should be observed in the construction of our future navy. I have simply directed attention to it as a subject of great importance, and one that I am satisfied will receive consideration on the part of the Admiralty and the Comptroller of the Navy.

The next question for consideration is the proper-

ties of iron best calculated to resist the penetration of shot at high velocities, and in this I am fortunate in having before me the experiments of the Committee on Iron Plates, which may be enumerated as under :—

Specific Gravity.	Tensile Strength in tuns per square inch.	Compression per unit of length in tuns.	Statical Resistance to punching in tuns ; one-inch plate.
7·7621	24·802	14·203	40·1804

The specimens subjected to compression gradually squeezed down to one-half their original hight, increasing at the same time in diameter till they attained 90 tuns on the square inch. In these experiments, four descriptions of iron were selected, marked A B C D : the two first and last were taken from rolled and hammered iron plates, excepting C, which was homogeneous, and gave higher results to tension and dead pressure than the others.

In density and tenacity they stood as follows :—

Mark on Plates.	Density.	Tenacity in tuns.	Remarks.
A Plates.....	7·8083	34·644	
B Plates.....	7·7035	23·354	
C Plates, homogeneous	7·9042	27·032	
D Plates.....	7·6322	24·171	

Here it will be observed that the strengths are in the ratio of the densities, excepting only the B plates, which deviate from that law. On the resistance to compression, it will be seen that in none of the experiments was the specimen actually crushed ; but they evidently gave way at a pressure of 13 to 14 tuns per square inch, and were considerably cracked and reduced in hight by increased pressure.

From the experiments on punching we derive the resistance of A B C D plates to a flat-ended instrument forced through the plate by dead pressure, as follows :—

Mark on Plates.	Shearing Strain in tuns per square inch.	Ratio, Taking A as unity.
A Plates.....	19·511	1·000
B Plates.....	17·719	0·907
C Plates.....	27·704	1·168
D Plates.....	17·035	0·873

Here may be noticed that the difference between the steel plates of series C, and the iron plates of series A, is not considerable, though in all the others the steel plates exhibit a superiority in statical resistance.

[To be continued.]

ROTTING HEMP AND FLAX.

This is a subject of much importance, just now, to our farmers who have raised crops of flax and hemp this season. There are two methods employed for rotting hemp, viz., dew-rotting and water-rotting. By the first method the plants are spread thinly and evenly upon the ground about the middle of October. Clean sward is preferable for the operations, and from six to ten weeks are required to complete them. The plants are occasionally carefully turned, and their condition is determined by taking up a handful and breaking them in the hand. When the shive or woody pith is found to separate easily from the lint the process is considered complete. Warm wet weather hastens the rotting operation, the object of which is to induce the action whereby the woody separates from the fibrous part of the plant. When the rotting is completed the plants are again bound in bundles and stacked until they are required to be scutched. Dew rotting generally injures the strength of the fiber more than water rotting, therefore the latter is held to be the better, although the most troublesome system. The method pursued by E. S. Cox, an extensive hemp cultivator of Sangamon county, Ill., is set forth in the Transactions of the State Agricultural Society, and quoted with commendation as follows, by the *Prairie Farmer*. In describing his method, Mr. Cox says :—For the purpose of water rotting hemp I have excavations made in the ground into which are built six framed vats 90 feet long by 9 feet wide and 6 feet deep, the tops being on a level with the ground. These vats are constructed of 36 by 8-inch sills laid crosswise, at each end of which upright 6 by 8-inch posts are mortised and keyed, and stayed at the top by an occasional cross timber. The bottoms, ends and sides are planked with 2-inch oak timber and ship caulked. The bundles of hemp are laid crosswise the vats, which are filled to the top. Four strings of planks or rails are placed lengthwise the vats, across the hemp, over which again cross timbers are placed and confined at each end under cap pieces projecting from the top of the vat. Thus is the hemp firmly confined under the water. The vats are then filled with water from a cistern arranged for the purpose, and the hemp is completely submerged, the water rising six inches above it. The water for rotting the hemp, by means of three very powerful suction or force pumps, is drawn from a creek near by through cast-iron pipes into a framed, planked and caulked cistern, 56 feet long by 15 wide and 6 feet deep, constructed above and at the end of the vats. This cistern, by the action of the pumps, can always be kept filled with water, which can settle and become clear and be let into the vats at pleasure.

The pumps and machinery for dressing the hemp are propelled by a steam engine, the escape steam of which is admitted into iron pipes laid at the base of the vats, and the heat thus communicated raises the temperature of the water in the vat to 90° Fah. With this temperature the hemp is rotted in five to seven days, the glutinous or cementing matter which fastens the lint to the stalk being dissolved by the process of fermentation, and the filaments of the wood becoming concrete and brittle are easily broken and separated from the lint. At this time all fermentation has ceased and the water is unpleasantly stagnant. The water is now let off through plug holes at the end near the bottom of the vat and passes off through a ditch into the creek. The hemp in a few hours is drained ready for throwing out. The confining timbers being first removed the bundles of hemp are then easily thrown out, two men emptying a vat in one half day, each vat holding stalk to make one tun of lint.

By this method of water rotting the business can be carried on every month in the year, in winter as well as in summer, as the water can be kept of a uniform temperature by means of steam. The workmen are protected from wet by oil cloths. The business is not unpleasant or unhealthy.

From the vats the hemp is hauled in carts to the drying grounds, where it is set up in shocks of three or four hundred each—a band being tied around the blossom ends to keep them from falling down, the old bands are cut and the stalks are well spread, the butts to the ground inclining outward. As soon as thoroughly dry it is bound in large bundles and secured in the store sheds ready for breaking.

For rotting flax similar vats may be employed. There are but few farmers however, who can afford to use a steam engine, therefore all those who may have the conveniences of running streams near their farms, should connect their flax pits with a stream in such a manner that the fresh water may be admitted at pleasure. Many experienced flax growers in Ireland prefer to sink their flax pits in yellow clay beds. They assert that the clay absorbs the oil of the plant, and also imparts a beautiful cream color to the flax, which enhances its value. These flax pits should be filled to within six or eight inches of the top, and soft water alone should be used. It is of no consequence whether the top or root end is downward, and a slanting position is best for it. We may here remark that the same water should not be used twice the same season, and a great economy is effected by the pits or vats being so constructed that the water from them could be made to flow over the same or other fields, thus restoring to the soil almost all the constituents it took from it. It requires to be covered securely with sods and other material to keep it under the water and to exclude the air during the fermentation. The rotting process will usually occupy from six to nine days or perhaps longer. The rule for testing it is quite simple ; remove a portion of the covering, take up a little of it and if found, on examination, the fiber or skin separates easily from the extraneous vegetable matter or pith, it is then fit to be taken up and spread to dry. The flax should be evenly laid on a clean grass field in equal layers, and care should be taken to keep the roots all evenly together through all its operations and prevent it from mixing, which injures it both to the farmer and spinner. The drying will occupy but a few days on the grass in good weather if the rotting has been properly done. It should then be lifted off and stacked in a very dry condition for at least a fortnight, when it will be ready for scutching, which may be done either by the hand or by machinery.

The scutching operation is simple, and may be performed during winter and at the convenience of the flax grower. Its object is merely to separate the pith from the fiber. From the previous action of the steeping and drying the pith becomes rotten and breaks easily by being passed through rollers having a fluted surface working on each other like cogs. This machine may be either cast metal or hard wood ; if of the latter, it can be driven by a man, and attended by boys. The cost of this machine should not exceed five dollars, and is very useful when the scutching is done by hand ; a stout boy may clean forty pounds for market in a day.

London Exhibition—Jewelry and Precious Metals.

The London *Times* contains elaborate and able articles on several branches of manufacture in the Great Exhibition. The following extracts are selected and condensed from its columns :—

Of all others, this is peculiarly the department of the Exhibition of which description is out of the question, and which "must be seen to be appreciated." It is a feast for the eyes, as rich as it is rare, to gaze on the piles of plate and heaps of glittering gems which fill the cases of the English goldsmiths near the center of the nave, or those of the French and Italian jewelers in their respective Courts.

As a rule, but scant praise can be given, in an artistic point of view, to the figure subjects in silver plate. There is for the most part a stiffness and conventionality about them which is very unprepossessing. Messrs. Elkington have acquired such a reputation for their bronzes as almost to eclipse their merit as silversmiths ; but their productions in the latter branch are the best in the Exhibition. The most note-worthy object in their collection is an emblematically adorned silver table, by Morel. It is executed in *repoussée* work, and its manufacture has occupied three years. This is the slowest and most difficult mode of working in silver. The relief on the metal is all beaten out from the inside by means of an iron rod, one end of which is placed in contact with the plate while the other is struck by a hammer. When skillfully performed, the labor is repaid by the superb effect obtained. The subject illustrated in the composition of Morel's table is "Sleep." At the base slumber the troubadour, the soldier, and the laborer. A column, encircled by poppies and other narcotic plants, supports the table on which the dreams of the sleepers are portrayed. The first has visions of love and fortune, the second of victory and fame, the third of peace and plenty. A fanciful border of gnomes and monsters typifies the horrors of the nightmare.

The combination of enamel and metal in the decoration of table ornaments is illustrated by some attractive specimens in Elkington's collection. The pattern is first cut out of the metal ; on the hollow spaces thus formed the enamel is placed, and fused under a violent heat. When cool, the rough surface is polished on a stone lathe. A dessert service in this style has a very attractive aspect. It is in the Pompeian style, and the enamels employed are of turquoise blue, red, and black. The service is valued at $10,000.

There are exhibited by Messrs. Bell, of Newcastle ; Manders, of Wolverhampton ; and Christofle & Co., of Paris, works in aluminum. This metal is white, with a bluish tinge. It lacks the brilliancy of silver, but, on the other hand, never tarnishes. By itself it is as malleable as gold or silver, but when alloyed with any other metal this property disappears. It is singularly light. Its weight is only a third of that of iron, a fourth of copper, and a fifth of lead. Not only is its complexion unaffected by air or moisture, but even by tartaric acid, salt or sulphur. This quality renders it very suitable for domestic purposes, while its lightness and hardness adapt it to scientific uses. For pure ornament, however, it can scarcely vie with silver. A casket of aluminum, 12 inches long by 8 in depth and 9 in width, is shown by Messrs. Manders.

In jewelry the English rely mainly on the value of the stones and the solid work of the mountings ; while the French display more fertility and ingenuity in the modes of setting. Of all the British exhibitors, Emmanuel exhibits the greatest novelty and variety in the treatment of jewels. He revives the ancient practice of combining gold and ivory,

and of setting rubies, emeralds, &c., in the latter substance. He also employs a beautiful pink shell as a base for certain gems, with a very agreeable effect. In the French collection there is much fancy in the jewelry, but it occasionally degenerates into mere oddity and caprice. In M. Rouvenet's case there is a remarkable brooch representing a dragon. The body of the monster is composed of a blaze of brilliants, and its wings are tipped with emeralds. It rests upon a scrollwork of branches and leaves formed of diamonds, with dark pearls at the points of the leaves. This has been purchased by the Pacha of Egypt. Other French jewelers show precious stones made up with the help of gold and enamel into a resemblance to butterflies, flowers, &c. An economical variety is offered in the convertible jewelry of M. Rouvenet and others. There is a bracelet, for instance, the brilliants of which can be taken out and used as a brooch. The greatest curiosity in this way is a ring set with a large brilliant, which on examination proves to be composed of six subsidiary rings. These can be opened out and united so as to form a bracelet, with the brilliant in the center. Moreover, the diamond can be used by itself as a brooch, and the setting will then do service as a broad gold ring or a link gold bracelet.

In the same Court may be seen some marvelously clever mock jewelry. One exhibitor mixes up real and false pearls together, and defies the visitor to tell the one from the other.

Castellani's jewelry is the feature of the Italian collection. It is in the antique style, and consists of reproductions of Greek, Etruscan, Roman, mediæval and cinquo-cento work. The finest pieces are a Greek crown of fine filigree, set with turquoises and other gems, and a Roman necklace, composed of flowers, shells, acorns, and heads of the Nymph Io. The *Mundas Muliebris* is represented by the jewel casket of a Roman dame. It contains separate rings and hair pins for every day of the week, onyx fibulæ, large triumphal ear rings, amphoræ necklaces, and lapis-lazuli case, containing a sort of rouge for hightening the complexion and restoring the bloom to faded cheeks. The gold employed is of a dull and intensely yellow hue.

Among the singular gems exhibited may be mentioned Garrard's black pearls, Emmanuel's opals of the are rainbow tint, Hancock's pink, pearls, and greenish diamonds, Phillip's sable coral, Rouvenet's black brown, rose, opal and straw colored diamonds, and Aubert's roseate amethyst, a new stone not long since discovered.

Messrs. W. Marshall & Co., Princes' street, Edinburgh, have a collection of brooches and other ornaments in the ancient Scottish style. Runic and mediæval forms are adopted and as a revival of an antique fashion. In those ornaments enamel is skilfully and tastefully combined with gold or silver. Some of those in silver with a blue enamel are very chaste and beautiful. Cairngorm stones and gold make a brilliant association. Gold and a black enamel is also tried, but is not equal in effect to the silver and blue. Granite jewelry is exhibited by Mr. J. Duncan, Mr. G. Jamieson, and Messrs. Rettie, Middleton, & Sons, of the "granite city," Aberdeen. Some of the specimens are very fine, the grain of the stone revealing depth and richness of hues. Messrs. Brydone & Sons, of Princes' street, Edinburgh, have a display of curious devices in hair which are very skillfully executed. In one is portrayed the Scott Monument. In another a weeping widow is seen at the foot of a weeping willow, and all of this is done out of the hair of the late lamented. The force of consolation can no further go!

JOHN BROWN & Co., manufacturers of armor plates in Sheffield, in a letter to the *Engineer*, state that they have manufactured plates of Bessemer metal for armor, and several of these have been fully tested by the Government. They have never been able to obtain plates of such metal sufficiently soft. "A 40-pound shot fired against a plate of Bessemer metal does more mischief than a 68-pound shot fired against an iron plate of equal thickness."

SIXTY-FIVE vessels sailed last week from New York for Europe, carrying 1,140,751 bushels of grain, and 40,138 barrels of flour, in addition to large quantities of provisions and assorted merchandise.

Correspondence

Turret Batteries, Stationary and Revolving.

MESSRS. EDITORS:—Will you permit me, through the columns of the SCIENTIFIC AMERICAN, to make some remarks upon that class of war ships styled the *Monitors*, which our Navy Department would seem to rely upon as constituting in future the strong arm of our national defence. It is but little over a year since we discovered ourselves to be almost without a navy, of either wooden or iron ships suited for defensive operations, yet in that brief period we have—completed and rapidly approaching completion—iron plated ships which will, if they come up to the anticipations of their designers, constitute a very formidable navy. Of all the different designs of war ships now under construction for our Goverment, we believe the *Monitors* are expected to render the most efficient service; but whether this expectation will be fully realized is a question which I believe can only be settled by actual test in naval engagements on a more extensive scale and with a more formidable fleet than will be likely to be put afloat by the short-lived Southern Confederacy. It is this internal enemy that our Government is now particularly preparing for, and it should not overlook the probability of having to contend before many years pass by with a much more formidable power, or powers combined. Therefore the stern necessity of providing a navy superior to that possessed by England and France ought to be kept fully before our national authorities, and too much reliance, until proved by severe test, should not be placed in any one particular class of war craft. And as regards the Ericsson battery I think there is yet room for improvement. I have believed and shall continue to believe until the contrary is proved to be the fact, that the security of the gunners against the explosion of shells that may enter the exposed ports of the Ericsson battery is a great desideratum, and sooner or later such a conclusion will have to be come to.

Suppose a naval engagement to take place in which a turret ship should be attacked from two different directions, the enemy's object being to pierce her ports with shell, could not the result of a few broadsides be, in all human probability, that they would succeed in exploding a shell in her interior, thereby killing or wounding every one of her gunners, and thus render the guns useless for a time at least. It would, in case of an attack from different directions, be impossible to keep the ports entirely out of range of some of the enemy's guns; for during a third of a revolution of the turret a shell may be made to enter the port coming from a single direction. The question then comes up, Can this danger be avoided? I think it can without detracting anything from the efficiency of the ship, or adding materially to the weight of the turret; by having an external and an internal turret, the external turret to be stationary, and secured to the ship, thereby strengthening by bracing that portion of the ship. The internal turret upon which the guns would be carried around would have its vertical wall as high only as would be necessary to extend a little above the ports in the external turret. Both turrets would be pierced with a suitable number of ports so spaced that but one would be opened at a time. Supposing a turret ship arranged in this way to be attacked by an enemy's fleet, the internal turret, until the instant a gun was to be discharged, would be kept in the position that would close all of the external ports, but at the instant the proper range is secured by the movement of the ship the internal turret is revolved to bring the two ports in range and the guns are discharged one after the other. When the ports are closed the guns are reloaded, affording the most perfect safety to the gunners, and instead of compelling the gunners to go below we would have them go above where they could witness the effect of every shot discharged from their guns upon the enemy's ships or forts. Could not a turret ship of this description, its armor being invulnerable, enter a harbor and make all the observations it could desire in perfect safety.

If there is any tangible objection which can be brought against this plan for a turret ship I hope that any of our scientific men who may see any such objection may not hesitate to point it out. The objection filed against the double turret by the naval authorities of our Government was that it would require an increased diameter and weight in the turret, and that they wished to avoid.

Now, if Captain Ericsson has, as is stated in the SCIENTIFIC AMERICAN of August 16th, concluded a contract with the Navy Department to construct two turret ships with turrets of two feet in thickness, it would seem that the department has come to a different conclusion, and that a little weight in a large ship is after all not so objectionable. The opinions of those who may command in future these experimental ships will have much to do with deciding upon their merits. Brave men will risk being shot down, but where it comes to the test of being blown to atoms by an exploded shell within the narrow walls of a turret battery, nothing short of a degree of recklessness which would be altogether at variance with modern civilization, could prompt men to face such peril. Neither should the brave tars who are so willing to risk all the dangers incident to naval warfare from exploded gunpowder, or the heated vapors escaping from a pierced steam boiler confined within the narrow walls of an iron ship, be exposed to such unnecessary danger where it is possible to avoid it.

S. L. DENNEY.

Christiana, Pa., Sept. 29, 1862.

[Captain Ericsson closes his portholes with heavy swinging plates, and it seems to us that this plan is far better than to make two turrets, the inner one revolving and the outer one stationary, as proposed by Mr. Denney. In Ericsson's plan the whole turret is revolved by means of a steam engine under the control of one man, and the perfect ease and unparalleled accuracy with which the guns can be kept constantly trained upon any part of a hostile ship by this means is an advantage of the very highest importance. If the turret is made stationary, the guns must be trained by turning the whole vessel—an exceedingly awkward maneuver, which it would be impossible to execute with sufficient rapidity and delicacy to direct the fire with reasonable precision. EDS.

How to Stow Potatoes and Preserve them from Rot

MESSRS. EDITORS:—I enclose a receipt for keeping potatoes, which may be useful to farmers, &c., as the rot is exceedingly prevalent. I have tried it for four years and it has proved a sovereign remedy as I have not lost a bushel in that time after they were harvested, though in some cases they were half diseased when taken out of the ground.

Dust over the floor of the bin with lime and put in about six or seven inches deep of potatoes and dust with lime as before. Put in six or seven inches more of potatoes, and lime again; repeating the operation till all are stowed in that way. One bushel of lime will do for forty bushels of potatoes, though more will not hurt them—the lime rather improving the flavor than otherwise.

If you are disposed to insert the above in your paper I think you will be doing the public a favor.

R. T. PARSONS.

That Flying Machine—A Disclaimer.

MESSRS. EDITORS:—My attention has this day been directed to an article in your issue of Sept. 27th, wherein an unauthorized and most unwarranted use is made of my name; I allude to the article headed "A Practical Flying Machine." A few weeks since I accidentally met a man in this city who, I was told, had invented a flying machine. After a conversation about his machine and æronautics in general, we parted without my knowing or inquiring his habitation or his name, which is now revealed to me in his communication as Jeremiah Randall, of West Jefferson, Ohio. He described his machine to me, but he did not exhibit either a machine or its model; neither did I make use of the language he attributes to me, nor did I in any way indorse, admit, or believe he had made or could make any practical flying machine. I am surprised he should so misconceive the whole tenor of my conversation, for my last advice at parting was, that he had better save his time and money by directing his attention to something else.

J. SULLIVANT.

Columbus, Ohio, Sept. 30, 1862.

New Musical Instrument.

Messrs. Editors:—On page 204, last volume of the Scientific American, under the head of "Subjects for Inventions," I notice the following suggestion:—"A Musical Instrument—An improvement in musical instruments so made that by passing a sheet of paper or other material through the instrument the desired tune may be produced. The object of this improvement would be to enable every family to enjoy the latest and best music or such selections as may be desired, without the requirement of educated manipulation of the instrument. The sheet or material by which the changes of sound are effected must be cheap and easily produced."

In answer to the above suggestion, I am happy to state, that I have invented an automatic attachment, which meets the requirements of the suggestion in every particular and without any exception whatever. The instrument may be either an organ, a melodeon or a piano forte, but probably with greater satisfaction and advantage to the two former than the latter; not, however, from want of any capability, but on account of a greater amount of work and expense attendant upon hammers than upon valves. The following is a comparative description: First, the price of such an instrument will be the same as the present cost of the organ and melodeon, with an advance of perhaps ten per cent on the piano; the present action of those instruments giving place almost entirely to the automatic arrangement, though both may be present at the same time. Second, the sheet music or music material will cost perhaps about 25 per cent more than the present common engraved sheet music. Third, the music is performed in all its parts, melodies and harmonies with mechanical exactness, by the turning of a winch; the tastes of the composer with regard to the piano and forte, &c., and to the management of stops, being dictated to the person turning by marks or signs duly placed on the music material when prepared.

Leon M. Cleuch.

St. Marys, Perth county, Canada West.

[We do not understand that our correspondent has actually made a full working instrument such as he describes, but that he has the plans for it ready, and desires to make the necessary arrangements with capitalists or manufacturers for its construction. We can only say that such an improvement if it can be practically realized will prove of much value. —Eds.

Trial of Stafford's Shot on Armor Plates.

Messrs. Editors:—My third test of projectiles took place at West Point at 3 P. M., on Monday the 6th inst., as you may have noticed by the *Tribune* of that date. The results are all I could wish. The target was constructed of 6 1-inch plates, manufactured for the turret of the original *Monitor*; the front represented two thicknesses, 4 and 6 inches, the backing was made of the best live-oak timber, 6 inches thick, firmly bolted with 1¼-inch bolts, the whole weighing 4,900 pounds. My first shot fired against the four plates was of an inferior manufacture, weight 46 pounds, charge 8 pounds of powder, range 119 feet; this shot, however, broke the four plates through, making a hole through the last one 9 inches in diameter, the piece being driven 2½ inches into the timber, and the backing very badly shattered. My second shot, same weight, charge, range, &c., was made with similar results; the gun was the Wiard steel gun, Dahlgren pattern. My next test was with same gun, with a more perfect shot, 36-pounds weight, 11 pounds of powder; this shot went clear through target and timber, cutting a hole in the front plate 8 inches in diameter, and in the fourth plate some 11 inches, carrying the wood off and breaking bolts in a terrible manner. A second shot with the same gun, weight, range, &c., was fired with even better results. I then fired a shot of 70-pounds weight, with 14 pounds mortar powder, 139 feet range, Parrott 100 pounder, through the six plates, the shot landing 300 yards from the target, on the east bank of the Hudson River. The shot could not be found. I then fired a shot same weight, gun, charge, &c., near the center of the 6-inch target. This brought the shot in range with a very heavy stone, some 3½ feet by 4, used as a support for the target. The shot went through, striking the stone near the center and breaking it into many pieces. Some of the braces, timber, pieces of iron, &c., were sent over a hundred feet. With this result I then gave notice to the Chief of Ordnance that I would fire same weight shot on an angle of 40° or 45°, the target being placed on an angle 43½°. I fired through, lifting the whole target clear from the ground and reversing its position. Thus ended my experiments on iron at West Point. The experiment will be repeated at the navy yard in Washington, by order of the Navy Department. I fired some of my navy shells from the Parrott 100 pounder, and 2 from the Dahlgren 50 pounder, the shell going some 4½ miles from the Dahlgren, the range from the Parrott was not yet known when I left West Point, but was believed by the crowd who witnessed the test that the first 2 shells, 70-pounds weight, 10 pounds powder, 20° elevation, went over the mountain, being some 5½ miles; this, however, is not positive. The weight of the shell fired from the Dahlgren was 49 pounds, 8 pounds mortar powder, 20° elevation. The whole test throughout is regarded a perfect success.

C. W. Stafford.

New York, Oct. 7, 1862.

Explosive Bullets.

[To the Editor of the London Engineer.]

Sir:—In the Scientific American of the 1st inst., there is a letter on explosive bullets being used by Southern Americans in the present unhappy war. And the editor's note on it is as follows:—"Explosive bullets are old and well known, but for some reason, probably owing to their expense, our Government have not used them. They were used in the Chinese war to set fire to ammunition trains." I inclose the letter of General Sir Richard Airey, which was embodied in my memorial to H. R. H., the Commander-in-Chief, proving that I invented the rifle explosive shell as far back as the year 1823; and also the report of the select committee at Woolwich, dated September 4, 1826. As the *Engineer* is invariably read by the editor of the Scientific American, I shall be much obliged if you will be so kind as to insert this communication, as I am sure from the high estimation in which that most useful journal is held, that the editor of it will be thankful for the correct history of the explosive bullet, which, as made after my fashion, does not cost more than one penny. J. Norton.

International Hotel, Bray, Wicklow.

September 15, 1862.

New Steamship "Eagle."

The trial trip of the new and beautiful paddle-wheel steamship *Eagle*, took place on the 7th inst., when she made a run down the bay, out to the Light Ship and returned. She was built by J. A. Westervelt & Son, of this city, and her machinery made at the Allaire Works. She is 238 feet in length; breadth of beam, 37 feet; depth of hold, 21½ feet; capacity, 1,560 tuns. Her machinery consists of a single beam engine, with a cylinder 75 inches in diameter; stroke, 12 feet. The "Sickles cut off" is applied to the valves. She is intended for the New York and Havana trade, and belongs to Spofford, Tileston & Co. Her trial trip was satisfactory; the speed obtained being 15 knots per hour; the wheels making 21 revolutions per minute under steam pressure of 14 lbs. on the inch. The wheels are 30 feet in diameter, and 10 feet broad in face.

Cotton in Algeria.

A French company has been organized in Paris for the cultivation of cotton in Algeria. M. Cordies, one of the members, lately made a report on the subject, which states that no doubt exists as to the possibility of advantageously growing cotton in Algeria, and that by doing so French manufacturers will be exonerated from paying a tribute to foreign growers of cotton.

[So says an Exchange. Cotton of a very superior kind can be grown in Algeria. We have seen some excellent samples at the French Exhibition of 1855. The trouble will be in organising a system of labor equal to the capability of the country to produce the staple.—Eds.

Connecticut Manufacturing News.

The *Commercial Bulletin*, Boston, says:—

The cotton mill at Fitchville is being enlarged, and is receiving extensive additions of new machinery.

In Meriden, on the 25th ult., the sewing bird machine manufactory, owned by Wm. Hale, was burned to the ground, and several other buildings were partially consumed, including the depot of the Hartford R. R., the shops occupied by Bradley & Hubbard, manufacturers of brass work, and N. C. Stiles, machinist.

The Merrow Manufacturing Company, in Mansfield, Conn., are running both day and night to fill a large contract for stockings on Government account. This contract will require about four months for its completion.

Photography at the Seat of War.

Decidedly one of the institutions of our army is the traveling portrait gallery. A camp is hardly pitched before one of the omnipresent artists in collodion and amber-bead varnish drives up his two-horse wagon, pitches his canvas gallery, and unpacks his chemicals. Our army here (Fredericksburg) is now so large that quite a company of these gentlemen have gathered about us. The amount of business they find is remarkable. Their tents are thronged from morning to night, and "while the day lasteth" their golden harvest runs on. Here, for instance near Gen. Burnside's headquarters, are the combined establishments of two brothers from Pennsylvania, who rejoice in the wonderful name Bergstresser. They have followed the army for more than a year, and taken, the Lord only knows, how many thousand portraits. In one day since they came here they took in one of the galleries, so I am told, 160 odd pictures at $1 (on which the net profit was probably ninety-five cents each). If anybody knows an easier and better way of making money than that, the public should know it. The style of portrait affected by these traveling army portrait makers is that known to the profession as the melainotype, which is made by the collodion process on a sheet-iron plate and afterward set with amber-bead varnish.—*Cor. Tribune.*

Science in Russia.

In St. Petersburg there is a building of vast dimensions, devoted to the use of the Academy of Sciences. This academy once enjoyed the labors of Euler, who constituted the whole of its mathematical department, and composed more than half the treatises in this branch of science, which are contained in forty-six quarto volumes, published from 1727 to 1783. This academy was founded by Peter the Great, in 1725, and under the influence of foreign professors, it has acquired a European reputation. It has a library of more than one hundred thousand volumes, and an extensive collection of manuscripts, some of which are of great value. In the museum of natural history there is a skeleton of a remarkable mammoth, well preserved, only a single foot being deficient. It is sixteen feet long, without including the tusks, and nine feet high. The skeleton of a common elephant by the side of it appears small in comparison. The monster to which this frame belonged was found in Siberia, in 1803, on the banks of a stream in latitude seventy degrees north.

Effects of Industry.

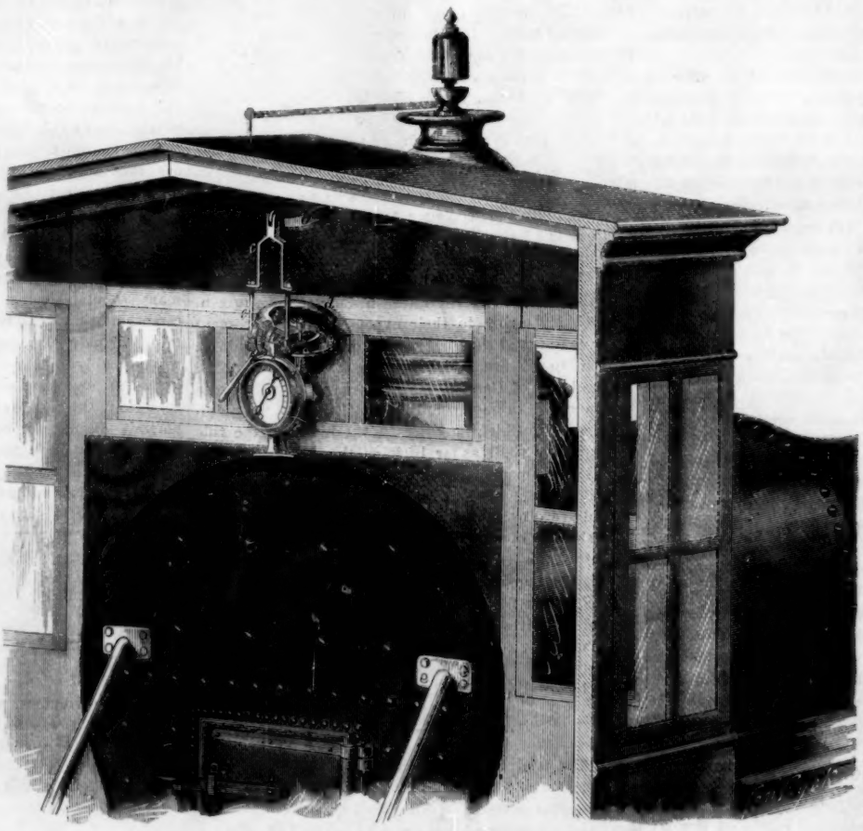
All the performances of human art, at which we look with praise or wonder, are instances of the resistless force of perseverance. It is by this that the quarry becomes a palace, and that States become united by electric wires. If a man were to compare the single stroke of a pickax, or one impression with the spade, with the general design and last result, he would be overwhelmed by the sense of their disproportion; yet these petty operations, incessantly continued, in time surmount the greatest difficulties, and mountains are leveled and oceans bounded by the slender force of human beings.

New Mode of Catching Trout.—Levi Bartlett describes in the *Country Gentleman* some trout ponds on the farm of Colonel Tappen, of Bradford, N. H., and speaks also of the mode of feeding. Last winter, after the ponds had frozen over, he states that a boy was sent to feed the trout with chopped meat. Having cut a hole through the ice and put in the meat, the boy lay down with his face near the water to watch the fish, when a trout grabbed him by the nose, and the boy by a sudden jerk of the head, threw the fish upon the ice. He thus obtained a trout of three-fourths of a pound weight, but at the expense of a sore nose for three weeks.

Improved Spring Balance for Safety Valves.

When a locomotive engine is running the safety valve is loaded sufficiently to keep up the working pressure in the boiler, but when the engine is stopped for a short time without the fire being drawn, a proper regard for safety requires that the load on the safety valve should be immediately reduced, and all careful railroad managers require this to be done. Heretofore the load upon the valve has been varied by turning a nut upon a rod, and it is necessary to turn the nut so far that engineers have frequently neglected to perform their duty in this respect with fidelity, thus exposing their engines to the danger of explosion.

On page 128 of Vol. IV. (new series) of the SCIENTIFIC AMERICAN, we illustrated a device by which the load could be instantly reduced to any extent or taken off entirely, by a single motion of the hand. The inventor has since arranged this device in connection with a steam indicator, and the annexed engraving shows the manner in which the two are applied practically to a locomotive engine.



GRAHAM'S SPRING BALANCE FOR SAFETY VALVES.

The steam indicator, *a*, is furnished with a pedestal by which it is bolted to the top of the boiler, and it is surmounted by the spring balance, *d*, which is connected with the lever, *b*, of the safety valve by the link, *c*.

The cap of the spring balance is represented as broken away to show the the internal structure.—The vertical rods, *e*, connect the lever of the safety valve with two side levers which are pressed downward by a flat elliptic spring, and the pressure of this spring is varied by the turning of an eccentric, which may be turned by means of the lever, *f*. The fulcra of the levers are so arranged that a slight turn of the handle, *f*, makes a large variation in the pressure of the spring, and thus but little motion of the hand is required to reduce the load upon the valve, or to throw it off entirely.

The arrangement of the parts will be more readily understood by an inspection of the cut on page 128, Vol. IV., as that is on a much larger scale.

The patent for this invention was granted, through the Scientific American Patent Agency, Dec. 18, 1860, and further information in relation to it may be obtained by addressing the inventor, Charles Graham, at Scranton, Pa.

Cast Iron Punches and Dies.

At a meeting of the Institution of Mechanical Engineers, England, E. A. Cooper stated that he had found cast iron stand best in a large hydraulic punching press, for punching out red-hot links for suspension bridges. A link 7½ feet long and 1 foot 8 inches across the eye, was punched out of 1 inch thickness of metal, by a cast-iron punch and die. He had tried steel punches, but they did not stand in punching more than half a dozen of such links. The frequent heating of the steel in contact with the hot iron in punching, soon rendered it useless. Cast iron punches and dies usually lasted about a month, in which time they punched out about 200 such large links.

A "Quarter" of Grain.

In the English markets, grain is quoted by the "quarter," and the price in shillings sterling. The quarter contains eight imperial bushels, or eight and a half bushels, 33 American or Winchester bushels equal 32 imperial bushels). The English shilling equals about twenty-four cents and two mills. For rough calculation we may reckon the sterling shilling at a quarter of a dollar, and to reduce London rates to New York bushel prices, divide the quoted shillings per quarter by 33. The telegraph reports a certain grade of wheat in London at 57s. or $14 25 per 8½ bushels. Or, dividing 57 by 33 gives about $1 73 per bushel. From this we deduct freights, waste, insurance, commission, &c., to get the corresponding price in New York. When flour is quoted by the barrel, we have only to divide by four to get the price in dollars, nearly. (Just now four shilling, sterling are considerably more than $1, owing to the price of gold, and the cost of exchange.)

VIDAL'S ROCK-OIL LAMP.

We here illustrate another novel idea for obtaining a lamp without a chimney that will burn rock oil without smoking. The plan consists in spreading the wick at the upper end in order that the flame may be brought in contact with a large surface of air, and thus may receive sufficient oxygen to insure perfect combustion.

The wick tube, A, is elongated and enlarged at the upper end, as clearly shown in the engraving; the sides being drawn a little towards each other at the middle of the opening so as to crowd the wick toward the edges and cause it to spread. The wick is split, and is forced upward by a pinion in the usual manner.

The handle is formed by attaching to the outer side of the ring as a brace, a match case, B, and the bottom of the lamp is roughened, by a coat of emery or in any other suitable manner, to furnish a surface for lighting the match.

The inventor says that this lamp has been tried successfully for lighting cars, and that it is very well adapted for the head lights of locomotives as well as for use in lanterns. It is also designed for use as a hand lamp for general household purposes.

The patent for this invention was granted, through the Scientific American Patent Agency, July 23, 1861, and further information in relation to it may be obtained by addressing the inventor, U. B. Vidal, corner of Broad and Noble streets, Philadelphia.

Papier Mache.

Papier mache is not always strictly mashed paper—however it may be occasionally—neither can it be uniformly designated as a composition, especially in the production of finer ornamental articles.—When consisting of the pulp of paper, boiled with glue or gum arabic, &c., the cheaper articles are made from it; but the better ornamental work is made by causing sheets of paper to adhere or to be consolidated together to any required thickness. The pulp is rendered nearly water-proof by uniting with glue a preparation of sulpate of iron; and almost total incombustibility is secured by combining with the water-proof pulp, phosphate of soda and borax. All present diversities of papier mache manufactures may be comprehended and classed under five divisions: 1st, fibrous slab made only with coarse fiber mixed with earthy matter, then, after the addition of a cementing size, the whole is well kneaded together with the aid of steam, and with the proper ingredients, the substance is made fire-proof; 2d, sheets of paper pasted together upon models; 3d, thick sheets or boards produced by pressing paper pulp between dies; 4th, carton-pierre, prepared from paper pulp or paper mixed with whiting and glue, pressed into plaster piece molds, backed with paper, and when sufficiently set, hardened by drying in a hot room; 5th, Martin's ceramic papier mache, consisting of paper pulp, glue, rosin, sugar of lead and drying oil, mixed in certain fixed proportions and kneaded together. It can be kept in a plastic condition for half a year by keeping the air away and kneading the mass occasionally.

SCIENCE OF IRON PLATES AND PROJECTILES.—We would direct attention to the able paper of Mr. William Fairbairn, C. E., F. R. S., on another page. It has been published in the *Engineer*, *Mechanics' Magazine* and *Artisan*, London, and contains a fund of practical and genuine scientific information.

The Scientific American.

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VOL. VII. NO. 16.....[NEW SERIES.]....*Eighteenth Year.*

NEW YORK, SATURDAY, OCTOBER 18, 1862.

THE FLOW OF GOLD.

Gold is now selling in Wall street at 22 per cent premium, and exchange on England at 135 per cent. The premium on gold is simply another term for the depreciation of our paper currency; the quotations might as well be, paper money 22 per cent discount, exchange 13 per cent premium. This makes exchange about 4 per cent above par. An old act of Congress fixed the value of the pound sterling at $4 44, while its actual value is a little more than $4 84, so that exchange when at par, is nominally at about 9 per cent premium. It is now nominally at 13 per cent premium above gold, which is really 4 per cent.

If Mr. Grinnell sends $100,000 worth of corn to England and has it sold there, he wants to get the pay for it to New York. At the same time Mr. Stewart buys $100,000 worth of cloths in England and he must send the pay for them from New York to England. In a simple state of society Mr. Stewart would send his gold across the Atlantic in one direction to pay for his cloths, while an equal amount was coming in the opposite direction to pay Mr. Grinnell for his corn; but this expensive, risky, and useless transportation of gold to and fro across the ocean is avoided by a simple arrangement between the exporter and the importer. Mr. Stewart takes his gold to Mr. Grinnell, who gives him in exchange an order on the agent in England for the money obtained by the sale of the corn. This order is called a Bill of Exchange.

When the imports of any country just equal its exports, bills of exchange will find just as many buyers as sellers, and they will be sold at par, but if the exports do not sell for enough to pay for the imports, then some specie must be sent abroad to settle the balance, and importers, sooner than pay the freight and insurance on this specie, will pay a moderate premium on bills of exchange. Four per cent will fully cover the cost of shipping gold, and, consequently, this is as high as exchange can go above the price of gold. By simply looking, therefore, at the money market reports in the papers, we are enabled to know that all the gold which is offered in market is being bought and shipped abroad.

The outward flow of gold from this country at the present time results from two causes, one permanent the other temporary. The permanent cause is the production of gold in California, the temporary cause, the large issue of irredeemable paper by the Government.

When any country is producing more than its share of currency the surplus will be distributed throughout the commercial world. This distribution is effected—like nearly all of the other operations of commerce—through the medium of prices. Currency is the measure of values. When there is a great deal of currency in proportion to other things prices will generally be high. If prices are high in any country, that country is a good place to sell things, and merchandise is consequently imported for sale; at the same time it is a poor place to buy things for export, and there is accordingly an excess of imports over exports, leaving a balance to be settled by the exportation of specie. When it was seen, in 1849, that California would produce annually a large amount of gold, the writer of this told his commercial friends, that as long as we produced more than our share of the specie product of the world the rate of exchange would be generally against this country—enough of the time to carry abroad the surplus over our share. The currency of the world is drawn to its natural level all over the globe by a law as universal and as irresistible as the force of gravitation which levels the water of the sea.

The temporary cause of the outflow of gold is the excessive issue of irredeemable paper by the Government. Our currency is worth nothing to foreigners, while by our own people it is regarded as more valuable than anything which they have to sell. Specie on the other hand is the only portion of our currency with which we can pay our debts or purchase commodities in other countries. Our specie, being worth more for use in foreign commerce than in domestic trade, is appropriated to its most serviceable use; it is shipped abroad. This movement too is effected through the medium of prices. The Canadian who brings a drove of horses for sale to our Government, as he cannot pass our paper money at home, buys gold to take back with him. The puffing up in prices brings a flood of imports from all quarters, making an excess above our exports to be paid in specie.

At the present time we are exporting, not merely the excess above our share of the California product, but we are sending abroad a large part of the specie portion of our currency; this being displaced by the Government paper.

ARMOR PLATES SMASHED WITH SHELLS—REMARKABLE GUN EXPERIMENTS.

Perhaps the most remarkable experiments that have yet taken place with guns of different construction and caliber, firing solid shot and shell, occurred at Shoeburyness, England, on the 16th ult. Members of a Government select committee on iron plates and ordnance, and Lords of the Admiralty were present. The first experiment made was with the Horsfall gun—a wrought-iron smooth-bore piece of ordnance of 13-inch caliber, capable of carrying a ball of 286 lbs., weighing twenty-two tuns and forged at the Mersey Steel and Iron works, Liverpool. A target representing part of the side of the armor-clad frigate *Warrior* was used. It consisted of 4½-inch iron plates backed with 18 inches of solid teak wood. The gun was loaded with a solid spherical shot and a charge of 75 lbs. of powder, and it was placed at the usual distance of two hundred yards from the target. The first shot was conclusive. It smashed through the entire target and completely destroyed it for further experiments.

Other trials of a still more important character succeeded. These were made with a Whitworth rifled breech-loading 12-pounder field gun of 4-inch bore, and a 70-pounder rifled naval gun. The object of these trials was principally to test their penetrating power with hardened flat-fronted solid shot and shell. Hitherto the shells which had been fired against armor plates of moderate thickness had been broken in pieces, and it had been held that vessels covered with 2½-inch plates were shell proof. The first trial was with the 12-pounder firing solid flat-fronted steel shot at a distance of 100 yards against plates of 2 and 2½ inches in thickness. In both cases the shot cut their way clear through the plates. The same gun was then loaded with a flat-fronted steel shell, containing six ounces of powder and the charge was 1 lb. 14 ounces of powder. No fuse was employed, as Mr. Whitworth stated that the heat generated in the shell when it struck the target would be sufficient to ignite the bursting charge. One shell passed completely through a plate 2 inches thick and an oak backing one foot thick, and the other pierced through the plate and burst in the backing, shattering it to pieces. This was certainly a most interesting experiment.

The 70-pounder naval gun was next tried against a target of 4-inch armor plates bolted upon an oak frame nine inches thick, attached by a framing of oak four inches thick covered on the back with 2-inch iron plates. The intervening space between the front and back frames was thirty inches, and the entire thickness of iron was six inches. The gun was loaded with a flat-fronted steel shell which weighed 70 lbs., the charge of powder was 12 lbs., and the gun was placed at 200 yards from the target. The first shell pierced clear through the 4-inch plate and the timber backing, and struck against the 2-inch back plate, which it cracked, then it burst and shattered the target.

The results of these trials surprised most persons present. The tremendous destructive power of the Horsfall gun—the largest wrought-iron cannon in England—was astounding. A huge hole, two feet square, was struck out of the plate by the spherical shot, and the surrounding iron was cracked in all directions, and made a complete wreck. On the other hand, the flat-fronted projectiles of Whitworth punched out clean holes in the plate without fracturing any of the surrounding portions. The power of great guns to penetrate armor plates has thus been demonstrated, and those present at the trials, it is said, appeared convinced that this cannon could have pierced through plates six inches in thickness. The London *Times*, which appears to have become the subservient organ of conservative government abuses, asserts that the balance of merit for general purposes lies with the Armstrong gun. But the *Mechanics' Magazine* asserts that the Horsfall gun has "successfully accomplished that which Sir Wm. Armstrong, with the whole resources of the nation at his command, has been after numberless trials unable to accomplish." The Lords of the Admiralty have been expending hundreds of thousands of pounds during the past two years in making experiments to see if iron plates of 4½ inches in thickness could be pierced with the largest Armstrong guns, and from their experiments, it would appear they had become about satisfied that their new iron-clad frigates were invulnerable, and yet this Horsfall gun, which has smashed the *Warrior* target to pieces with a single shot, has been lying at Portsmouth in charge of the Government officials for six years, during which period all trials with it were pertinaciously refused. The *Mechanics' Magazine* asserts that three million pounds (about $15,000,000) have been expended uselessly in the construction of Armstrong guns. The Horsfall gun must be of great strength as the charge of powder used was prodigious. For short distances the penetrating and smashing power of spherical shot fired from smooth-bored guns is greatest; but for great distances rifled guns and elongated shot are superior, because the round shot in its flight meets with so much greater resistance from the atmosphere.

EXPLOSIONS OF BOILERS AND THEIR CAUSES.

The illustration and description of the explosion of the locomotive on another page, together with the very valuable scientific information on the water explosive hypothesis, will be appreciated by all who are interested in steam engineering and the chemistry of iron and water. Our opinion respecting the cause of steam boiler explosions is that they are due to an overpressure of steam. On page 89, Vol. I. (new series) SCIENTIFIC AMERICAN we said upon this subject, "We have taken the position that an excess of steam pressure in proportion to the strength of boilers is the cause of explosions." This opinion we have reiterated on several occasions. We admit that from accounts received of various explosions it is scarcely possible to account for them upon this theory, but in nine cases out of every ten they may be traced to an overpressure of steam in the boilers. Two new theories of boiler explosions have been published within four years. The one by Mr. Zerah Colburn; the other by D. K. Clark—both railway engineers and writers on machinery. A contributor to the New York *Times* claims Mr. Clark's theory for Mr. Colburn. He says: "Just after the *Great Eastern's* funnel-casing exploded a party of engineers in London were attempting, with little success, to reconcile any old theory with the phenomena here exhibited, when a new theory was proposed, which, after running the gauntlet of professional criticism, assumed such importance that Mr. Zerah Colburn, an American, and the probable author of the theory, wrote a book about it, and Mr. D. K. Clark explained it in the *Encyclopædia Britannica*." Quite recently, while experimenting for a very different purpose, Mr. Edwin Stevens, of Hoboken, developed the great fact upon which its probability depends. Water cannot exist as water under the atmospheric pressure at a higher temperature than 212°. Now the temperature of the water in a boiler under steam pressure of 100 pounds is 330°. If then the steam pressing on the water can instantly escape as through a rupture caused by mere weakness of the metal or by over-

pressure, a great part of this water at 330° will instantly flash into steam carrying the rest with it at about the velocity of a cannon ball. So far we know. The theory is that this flying body of inelastic water-particles operates like so many projectiles—like a broadside of grape—tearing into pieces everything within reach."

We alluded to the statements of this writer on page 137 of our present volume, and would not now refer to them but for the purpose of further exposing their erroneous character occasioned by a recalcitrant article in the New York *Times* of the 25th ult. In the above extract the impression is conveyed that Mr. Clark has indorsed Colburn's theory and amplified it in the *Encyclopædia Britannica*. This is not so, for Mr. Clark has repudiated the steam percussive theory of Mr. Colburn in two letters to the *Mechanics' Magazine* of May 3 and 10, 1861.

The experiment of Mr. Stevens is of no consequence for or against these theories. The statement above, that water will fly with the velocity of a cannon shot, is so unscientific that no person acquainted with mechanical philosophy, upon reflection, would have made it. The velocity of water flowing into a vacuum under a pressure of 160 pounds on the inch is but 116.72 feet per second, whereas the initial velocity of a spherical cannon shot is over 1,700 feet per second. The heated water that evaporates into steam in a boiler relieved of pressure by the escape of steam through a rupture is necessarily of low pressure and not very destructive. This is according to a well known law.

At the period of the explosion on the *Great Eastern* the correspondents of the New York *Times* and the *Engineer* were on board, but for want of a proper consideration of the case they mystified it amazingly. The most profound of living engineers has cleared up the subject in a very few lines. In Fairbairn's "Information for Engineer's," pages 305 and 306, he says: "In the disastrous accident which attended the first trial trip of the *Great Eastern* the funnel of the boiler, which was surrounded by a water jacket, gave way by a collapse at what was probably low pressure. This might easily have been prevented had the maker been aware of the extreme weakness of such flues when of large diameter and great length. The funnel, six feet in diameter, is in this case (which he illustrates with a diagram) exposed to the pressure of steam together with that of a column of water nearly forty feet in depth, and these two forces were quite sufficient to collapse the funnel and cause the frightful explosion which occurred."

Mr. Fairbairn believes that explosions are due simply to an overpressure of steam in boilers, in proportion to their strength, and no man living has made so many accurate experiments with steam boilers. In the report of May 7, 1862, of Mr. L. E. Fletcher, Chief Engineer of the Manchester Association for the Prevention of Boiler Explosions, he presents similar views respecting the cause of explosions. He says, in alluding to several cases, "It will be seen that all the above explosions occurred from the most simple causes, and that no mystery can be attached to any one of them. By suitable construction of the boilers in the first place, and due attention to their state of repair in the second, these explosions could in every case be prevented. * * * I find by far the most frequent cause of explosion is the insufficiency of the boiler for its working pressure, either on account of its original construction or want of repair." These remarks of Mr. Fletcher should "be written in letters of gold." They are of the greatest importance to every person who makes or uses a steam boiler.

A FRENCH SAVANT ON THE MANUFACTURE OF STEEL.

At the regular meeting of the French Academy of Sciences, held in Paris on the 18th of August last, M. Fremy, who is well known among scientific men for his researches into the nature of steel, read another memoir on the subject. He gave it as his opinion that steel would yet take the place of other metals in the manufacture of guns, and that it would yet supplant heavy wrought-iron plating in armor ships. "Those nations" he said, "which do not strive to keep up with the march of science, will very soon be left in a position of inferiority." The English method of making steel he held to be excellent, but as it is made in crucibles not holding over 44 lbs. it could not be obtained in very large masses. This method of making steel is also very costly, as it requires the use of the best malleable iron, and about seven times the weight of the iron, for fuel, during the process. France could not compete with England in making steel by such an expensive system. M. Fremy has therefore made experiments, and investigations to make good steel by another method. When he commenced operations, it was generally thought necessary to get Swedish or Russian iron to obtain a proper quality of steel, because it was believed that only a peculiar quality of iron ore possessed "a steeling propensity." He desired to clear up this metallurgical mystery, and he asserts that he has succeeded. When in England he had an opportunity of witnessing Bessemer's process in operation, and although much impressed with the magnificence of the system it left serious doubts in his mind respecting the quality of the steel. He left England with the impression that the cast iron of France, reduced by coke, contained too much sulphur and phosphorus, to be converted into steel; but experiments made by him at the works of St. Seurin have dissipated his fears. The Bessemer process converts French pig iron in about twenty minutes into a kind of burnt azotized malleable iron which is very "red short," but when to this is added some cast iron of the specular quality in the proportion of 1 ounce to 40 lbs. good steel is produced. Experiments were made on a large scale, and it was found that good steel could be obtained from any pig iron which could be refined. English workmen have examined the specimens of steel there obtained, and they pronounce it equal to English steel. It has been made into chisels, knives, gravers and other cutting tools. M. Fremy believes that a great revolution is about to take place in the metallurgy of iron. We judge from his experiments, that good c st steel may be manufactured in America from most of our pig iron. Several tuns of steel have been made by M. Fremy, from pig iron which he had supposed was totally incapable of being employed in the manufacture of steel.

MISCELLANEOUS SUMMARY.

Wrecks of British Vessels.—From the statistics, recently published, of disasters that occurred on the coasts of Great Britain in 1861, we learn that there were 1,494 wrecks, embracing a registered tunnage of 253,238 tuns. The number of persons employed upon them was 11,040. Respecting the classes of vessels lost, there were 487 engaged in carrying coal. These vessels make numerous and short voyages; they run close along shore and are not provided with modern improvements for shortening sail and braving heavy gales. Of the lotal number lost, only 42 were steamers. The number of lives lost was 884.

The Preparation of Flax.—A corespondent of the Montreal *Herald* mentions a discovery in the mode of preparing flax, which seems equally applicable to the Northern and elevated portions of the United States and Canada. He observes:—It has been discovered that in Lower Canada we can prepare our flax for the mill with very little trouble or expense, by a mode which answers as well as steeping, and that is, to spread the flax on a meadow in December, and allow it to remain on the ground till April. The winter snow rots it effectually, and when the snow goes off in April, you will find your flax clean and dry, ready for carting to the scutch mill, without any expense worth mentioning.

Ammunition.—Some idea of the amount of ammunition required to supply an army, such as Gen. McClellan's, during a heavy fight like that of the battle of Antietam, may be gained from the fact that thirty-eight tuns of ammunition were forwarded to Gen. McClellan from Washington, via Baltimore, Harrisburg and Hagerstown. An eye witness of the battle states that he counted, at four different times during the day, the number of discharges from the Union artillery, and found that they were made at the rate of seventy-eight to the minute.

The Philadelphia steam fire engine *Hibernia* has been taken to Washington, accompanied by ten skillful firemen. It is in the quartermaster's department, and has been secured as a measure of safety from fire, for the enormous quantity of Government stores in the city.

The Vitality of the North.—The population of the loyal States is about 23,000,000, or 5,000,000 more than that of Great Britain and Ireland in 1813, and about 5,000,000 less than that of France in 1813. Our wealth and natural resources are superior to either of these nations in 1813, and, instead of being twenty years at war, this is only the fifteenth month of our war; whereas France and Great Britain, in 1813, were both exhausted by twenty years of war, when they placed the vast armies of a million men in the field, armed and equipped.

A balloon for scientific purposes has been built in England by Mr. Coxwell. It is fifty-five feet in diameter and sixty-nine feet in length. The builder proposes to ascend five miles, for the purpose of making observations on the temperature and humidity of the air at different hights. He will use Professor Thomson's electrometer for electrical experiments. Trigonometrical observations are also to be made.

Petroleum for Europe.—The Portland *Price Current* says, the large whale ship *Omega* is about to load petroleum at that city for Europe. There has been exported from that port since January 1st, to the 20th of September, 87,200 gallons of petroleum, and from the United States during the same time, 6,242,912 gallons.

It is a common notion with many people that the morning air is the purest, most healthful and bracing; but the contrary is the fact. The air is then more full of dampness, fog and miasm at about sunrise which the heat of the sun gradually dissipates. Before engaging in anything like work or exercise out-doors it is conducive to take a cup of warm coffee and milk if breakfast cannot be prepared beforehand.

A Nice Flower for a Button Hole.—There is a plant in the island of Sumatra, the circumference of whose fully expanded flower is nine feet; its nectarium is calculated to hold nine pints; the pistils are as large as cow horns, and the whole weight of the blossom is computed to be fifteen pounds.

How to get ahead of Time.—The Alta *California*, of August 24, has this paragraph:—"The telegraph worked bravely last night. Our latest dispatches are dated Washington and New York, twelve o'clock, midnight. They reached us at ten P. M., two hours before they were transmitted."

Baked Quinces.—This fruit may be baked like apples, adding sirup, or sugar and water, while baking. Certainly every one who likes a sour baked apple will relish a baked quince. They are very good simply baked, and eaten with powdered sugar.

Heroism of an Engineer.

The express train from the West, on the Central road, due at Albany at half-past three P. M., Oct. 6th, ran off the track four miles west of Little Falls, through the displacement of a switch, throwing the locomotive, baggage, smoking and five passenger cars off the track. The accident occurred on a part of the track where the embankment on one side was six feet deep. When the engineer, whose name is Wemple, saw the danger, he applied the patent brake, communicating from the locomotive to all the cars, and, resolving to save the passengers, stuck to the engine till it was pitched down the embankment, and a total wreck. The brave fellow miraculously escaped with slight injuries. The fireman was seriously injured. The baggage car was also thrown down the embankment. Owing to the application of the brake the speed of the cars was so far checked that although five cars went off the track not a single passenger was injured in any degree. Sanford E. Church and family, State Engineer Taylor and Secretary of State Ballard, were on the train. The escape is wonderful, as the train was going at full speed.

Proportion of Males and Females in the United States.

According to the United States census of 1860 there were at that time about 730,000 more males than females in the United States, a fact unprecedented in the census of any other civilized nation. In most of the older States there is an excess of females; in Massachusetts 37,600 more females than males, while in Illinois there is an excess of 92,000 males; in Michigan 40,000 excess of males; in Texas 37,000; in Wisconsin 43,000; in California 67,000; and in Colorado there are twenty males to one female.

ENGINEERING EXAMPLES—THE BRUNELS.

The foreign quarterly reviews, published by L. Scott & Co., this city, sometimes contain very able articles on science, art and engineering. In the last number of the *London Quarterly*, there is an interesting essay on two of the greatest engineers of the present century, namely the two Brunels, father and son. The elder Brunel has perhaps been most widely known as the engineer of the great tunnel under the river Thames in London; the son as the author of the broad gage on railways; the engineer of several stupendous bridges, and the designer of the steamer *Great Eastern*. Sir Marc Isambard Brunel, the father, was born in 1769, at Hacqueville in France, and when eight years of age he was sent to college to be educated for the priesthood. He early exhibited such a predilection for mechanics, that he neglected theological studies, and greatly pained the heart of his father, who sometimes shut him up in close confinement, and whipped and coaxed him by turns to make him cease constructing wooden clocks, water wheels and windmills; but all in vain. Brunel was born an inventor, and it formed part of his existence to construct machines. When he arrived at seventeen years of age, his father, who had a very strong affection for him, obtained a situation for him as an officer on board of a French war vessel. Being a good mathematician and draftsman, he soon became a good navigator, and he constructed his own nautical instruments. The French revolution broke out about this time, and he being a fervent royalist had to fly for his life, and so he came to New York in 1793. Here he resided for six years, and made a moderate livelihood as surveyor, architect and civil engineer. It is stated that he designed several buildings in this city, also some of the fortifications in the harbor. He went to London in 1799, and was soon engaged by the British Admiralty in constructing self-acting machinery, which he had invented for making ships' blocks. In this he was very successful, and his reputation as a mechanical genius was established. Having received a considerable sum for his invention of ship-block machinery, he then designed machinery for making shoes, and engaged in this business; but, although an able inventor, he was a very indifferent merchant, and was soon involved in debt, and put into prison, from which he was kindly relieved, by the British Government paying $25,000 to satisfy the claims of his creditors. In 1822 he invented a carbonic acid gas engine, as a substitute for the steam engine, intending to use liquid carbonic acid, which is very sensitive to the influence of heat. But, like many persons of the present day, he did not understand the subject fully, and failure was the result. About this time, it was publicly proposed to make a tunnel under the river Thames in London, but no good method for accomplishing the object was proposed. The attention of Brunel being directed to the subject, it is stated that, while he was in the navy yard one day, he lifted a piece of timber which had been penetrated by the *teredo navalis;* and while examining the little mollusc, he found that its head was armed with a pair of strong shell valves, and that it worked into the wood by having its nose attached as a center bit to the timber, while its shell moved like an augur. In this manner it was enabled to bore under water, into the planking of the stoutest ship. Reflecting upon this natural method of boring under water by this little shell fish, Brunel was led, step by step, to invent peculiar mechanism, embracing a slowly-rotating shield, for forming tunnels under ground, and he secured a patent for his invention, submitted his plans to a number of scientific persons, as adapted for tunneling under the Thames, and the result was the formation of a company, with a capital of $1,000,000, to carry out his plans. Brunel, being appointed engineer, constructed a great tunneling machine, upon the basis of the *teredo navalis*. It weighed 200 tuns, was divided into several parts, and was operated by a powerful steam engine. The work of tunneling was of a very difficult character. The river broke in several times, and operations ceased occasionally for a long period. Arrangements were made to commence the undertaking in 1825; it was not complete and opened until March 1843, a period of eighteen years. Some idea of Brunel's arduous labors may be learned from one fact. While the excavations were going on by night (it went on by night as well as day), he was awakened, by his own orders, every two hours, and informed of its progress. His house was close to the tunnel, and when a bell in his bedroom was rung from below, he arose, struck a light, and examined a portion of the excavated soil which was sent up to him in a tube for inspection. A record was then made in his journal, he gave such instructions as were necessary, and went to bed again. For several months after the tunnel had been finished, such was the force of habit, that he used to awaken regularly every two hours during night. The Thames tunnel was successful as a great feat of engineering, and the genius and endurance of Brunel shone conspicuously in all that was achieved, but it cost $2,320,000, which was more than double the original estimates, and it was next to useless after it was finishde. It proved disastrous as an investment to all who were concerned in it. Brunel died at the advanced age of 81 years, in December 1849.

Isambard Kingdom Brunel, the son of Marc, became quite distinguished as an engineer when a youth, he acting as assistant engineer of the tunnel to his father. When it was completed, he devoted himself to railway engineering, and being somewhat ambitious perhaps for distinction, he projected the wide gage of seven feet, for the Great Western Railway in England. He produced many arguments to show that it was preferable to the common narrow gage of four feet eight and a half inches, which had been adopted by George Stephenson and others. Brunel's plan was violently attacked by leading engineers, but he was successful in carrying out his wishes. This was the parent of wide-gage railroads, and it is the most magnificent railway in the world. Some of the structures on it are splendid exhibitions of daring engineering skill. One viaduct over the river Trent is 880 feet in length; it is supported by eight elliptical arches of seventy feet span, having a spring of eighteen feet in the center. Gigantic square columns rise in pairs from a broad square basement, each pair being united at the top by bold architraves, forming the pier from which the arches spring. The structure imparts the idea of massiveness combined with elegance. A bridge on the same line, at Maidenhead, consists of ten brick arches, two of which are 128 feet span, each with a spring of only twenty-four and a half feet. They are the flattest arches ever made in brick. Brunel was apparently fond of executing daring projects, and doing things differently from other engineers, but he sometimes committed great mistakes. He became engineer of the Croydon and South Devon Company, for constructing an atmospheric railway, which he advocated against the opinions of several scientific engineers. He invested $100,000 in the project and lost it all, as it was a complete failure. Compressed air with stationary engines was not found equal to steam locomotives; and in view of this fact, one of its shareholders, in 1848, described himself and his fellows, "as the most unfortunate proprietors of the most unforunate railway in the kingdom."

The younger Brunel was the engineer of several railways, and all the structures which he designed are distinguished for boldness and grandeur. We can form but a very inadequate idea of the great bridges and viaducts, and other similar structures on English railways, from those on most American railways. Take for example one of two similar bridges, designed by Brunel, and constructed under his superintendence. It is called the Saltash Viaduct, and passes over the river Tamar, on the Cornwall Railway. It consists of nineteen arches, seventeen of which are from seventy to ninety-three feet span, and the two main central spans are no less that 445 feet each. These two central arches span the river with a double leap of 910 feet, and ships sail freely under them. This is called a bow-string girder bridge. The central spans are formed of wrought iron tubes, each of which weighs over a thousand tuns. This viaduct is a combination of the tubular and suspension methods; it is cyclopean in character, is 300 feet larger than the Britannia bridge, and it is one of the greatest triumphs of engineering skill in the world. The steamer *Great Eastern* has also tended to extend the fame of the younger Brunel, and it was his last great engineering achievement. While being constructed, and especially while it was being launched under so many mishaps, his health was seriously impaired by incessant labor and anxiety. After this vessel had been launched, and made ready for her first trip, he went on board of her, but she did not sail for a week afterward. During this brief interval, the great engineer who had projected her, was seized with paralysis, and just as she was gliding down the river to the sea, his spirit left its earthly tabernacle, and entered upon its voyage to "the spirit land." The younger Brunel did not possess the mechanical ingenuity of his father, but he was one of the boldest engineers that ever lived, and his ideas were of the grandest kind. "He was the Napolean of engineers," thinking more of glory than of profit, and of victory than dividends. He was ambitious to construct the greatest railway, and the greatest steamship in the world, and he succeeded. But although many of his projects were financially unprofitable, he was not a selfish speculator in schemes at the expense of others; he was always ready to invest a large portion of his own fortune in all the projects which he proposed. The lives and labors of the two Brunels, both in those objects which were successful, and in those which were failures, afford lessons in engineering to future generations.

VALUABLE RECEIPTS.

Removing Stains.

Ox gall is an excellent article for removing oil stains from delicate-colored fabrics. It often fixes and brightens colors, but will slightly soil pure white materials. Alcohol or strong whisky washes out stains of oil, wax, resin and pitchy or resinous substances; so also does spirits of turpentine, and generally without injury to colors. The turpentine may afterward be removed with alcohol or whisky. Common burning fluid, which is a mixture of alcohol and turpentine (or camphene), is an excellent solvent of oil, wax, tar, resin, &c., and it soon dries off after use. Ink stains, or iron mold, may generally be removed with the juice of lemons or of sorrel leaves. If these fail oxalic acid is almost infallible. Moisten the stain spots with water and rub on a little powdered oxalic acid which can be cheaply obtained at any druggist's. Wash off the acid very thoroughly soon after it is put on or it will eat the fabric. If children are present remember that oxalic acid is poisonous in the mouth though not so on the hands, if not kept long upon them.

Moistening a cloth and holding it a few minutes over the fumes of burning sulphur will bleach out most colors and stains. Be careful not to burn the fabrics. The fumes may be conducted to any particular spot by a paper roller in funnel shape (or a common tin funnel), held over the fumes of sulphur burning upon a shovel. The sulphur fumes are specially applicable to stains of fruit, and of vegetable juices generally. These may frequently be removed by dipping the fabric in sour milk and drying it in the sun, repeating the operation several times if needed. All oily substances [except paint oils] can be expelled from carpets by holding a very hot iron as near as it can be placed without burning. Porous paper or common brown paper laid upon a grease spot and run over several times with a hot sad-iron (flat-iron) will absorb the oil.

The above we quote from an exchange and it contains some very useful information when properly explained. Ox gall has been used from time immemorial by jobbing dyers for removing grease stains from delicate-colored woolen fabrics. It is mixed with cold water at the rate of about three gallons to the contents of one ox gall. The fabric is immersed in this and squeezed between the hands, or slightly pounded until the stains are removed. The fabric must then be very thoroughly washed in cold water, for if any of the gall is left in it the odor becomes very offensive. Strong cold soap suds or a bath of dilute aqua-ammonia, is preferable to ox gall in cleaning such fabrics.

Oxalic, acetic, or any other acid must never be used to remove ink and iron stains from any kind of cloth but that which is white, because these acids will discharge pink, lilac and other colors. The best way to use oxalic acid to remove ink stains from white muslin is to put some of the crystals of the salt upon the stain—making a small bag of the cloth between the fingers—and pour some hot water upon them until they are dissolved when the stain will have disappeared with the crystals of the acid.

A mixture of alcohol and turpentine (burning fluid) is excellent for removing grease and other stains from light-colored gloves and silks. Benzole is also equally as good; but when using these substances beware of coming near a fire or a light of any kind, as they are very inflammable, and many painful accidents from burning have occurred by their careless use.

Sulphurous acid gas, obtained from burning sulphur in the atmosphere, as described in the above article,

will destroy the colors of several stains; but those whose business it is to clean colored fabrics, do not use it for such purposes. Sour milk contains lactic acid, and it was once extensively used in the bleaching of linen. It is a very safe recommendation. Oily substances connot be expelled from carpets by holding a flat-iron near them, as stated in the concluding part of the above receipt. Strong cold soap suds will remove oil from carpets, and those who make a business of cleaning them use nothing else.

PREMIUMS OF THE AMERICAN INSTITUTE.

The American Institute holds no fair this year, but they will award fifty premiums, consisting of gold and silver medals. One half of the subjects have been referred to the Farmer's Club, and one half to the Polytechnic Association. The articles and essays must be presented by the first of December next.

The following is the list of subjects referred to the Polytechnic Association :—

1.—For the best Machinery for Spinning and Weaving Flax..... Gold Medal.
2.—For the best Lifting and Force Pump—by hand power..... Silver Medal.
3.—For the best novelty in Building Materials, and Machinery for preparing the same..... Silver Medal.
4.—For the best novelty of practical value extracted or manufactured from Coal Oil, Coal Tar or Petroleum. Silver Medal.
5.—For the best samples of Steel or Semi-Steel made direct from Cast Iron, with the process of manufacture, and the cost of producing the same..... Gold Medal.
6.—For the best novelty in the Construction of Railroads..... Silver Medal.
7.—For the best novelty in Warming and Ventilating Buildings, having especial regard to health, safety and economy..... Silver Medal.
8.—For the best Essay on the Measure of Power..... Silver Medal.
9.—For the best original Researches or Monographs on any subject pertaining to the science of chemistry or mechanics, or their practical applications..... Gold Medal.
10.—For the best samples of American Manufactured Flax Fabrics, with the cost of manufacture..... Silver Medal.
11.—For a cheap and easy test of the true value of Lubricating Oils..... Silver Medal.
12.—For an easy and economical method of procuring the pure fatty Acids from crude materials..... Silver Medal.
13.—For an important discovery or invention in Photography..... Silver Medal.
14.—For the best original Research upon the artificial formation of Saltpeter..... Silver Medal.
15.—For an easy test of the detergent strength of Soaps. Silver Medal.
16.—For the best specimens of Silver or Gold Plating on Glass..... Silver Medal.
17.—For a cheap preparation of Aniline Colors..... Silver Medal.
18.—For a cheap preparation of Metallic Calcium..... Silver Medal.
19.—For a cheap preparation of Silicium..... Silver Medal.
20.—For a cheap preparation of Magnesium..... Silver Medal.
21.—For the best mode of constructing Fireproof Buildings..... Silver Medal.
22.—For a simple method of crystallizing Sugar from Sorghum..... Silver Medal.
23.—For the best Water Meter..... Silver Medal.
24.—For the best Lamp to burn Kerosene Oil, producing perfect combustion..... Silver Medal.
25.—For the best plan for burning Kerosene Oil for heating purposes..... Silver Medal.
Three Discretionary Premiums (Gold or Silver Medals)—to be determined by the Board of Managers.

The Polytechnic Association meets at the rooms of the Institute in the Cooper Union, every Thursday at 7½ o'clock. The articles and Essays must be presented previous to the 1st of December next.

Circulars containing full particulars may be had at the rooms of the Institute, No. 22 Cooper Union. Communications should be addressed to PROF. RENWICK, Corresponding Secretary of the American Institute.

RECENT FOREIGN INVENTIONS.

Manufacturing and Coating Zinc Tubes.—A patent has been taken out by John Weems, of Johnstone, Scotland, for manufacturing cheap metallic tubes, to be substitutes for tubes of brass. The patentee states that he forms tubes of zinc, by passing the metal strips through dies or rollers; and the overlappings or contiguous edges of the metal are brazed or soldered with the aid of the blow pipe. The tube is then passed through a die, in order to impart a smooth finish thereto. It is then to be coated with copper, either by a galvanic battery, or by immersion in cold or heated solutions of the salts of copper, suitable for precipitating the metallic base upon the surface of the tube. These tubes may also be coated or plated with compound solutions of metals, or their surface may be coated with tin, bronzed, or lacquered.

Gas Apparatus.—Magnus Ohren, of Sydenham, Kent, England, an associate of the Institution of Civil Engineers, in describing an improvement which he has made in mechanism, connected with the manufacture of gas, says, "It is a known fact, that, although a gas exhauster, working at level gage, draws off a considerable portion of the gas produced in a retort, still a pressure is maintained in the retort, and consequently, a large portion of gas is thereby destroyed in the retort." To remove this pressure from the retorts, he claims the use of a movable disk, whereby the water in the hydraulic main is kept at one uniform level—just sufficient to seal the pipe when the retort is at work. The movable disk can be raised or lowered effectually by the use of a screw and wheel, with a pointer attached, to show the lineal opening. On the movable disk being lowered, the water from the hydraulic main will flow away, and the pressure will be removed from the retort to such an extent, that the whole of the gas evolved can be drawn off by the exhauster at level gage.

Soldering Type Letters for Compositors.—To facilitate the work of compositors, L. George, of Paris, has taken out a patent for an easy method of soldering two or more of those letters together which most frequently occur in the English language. He takes an amalgam prepared with two parts of mercury and one of tin, and rubs a little of this on the surface of a thin plate of lead, then presses the broadside of the two type letters upon it, and they are thus kept for about half an hour, when they will be found adhering together firmly.

Manufacture of Soda.—The common method of manufacturing carbonate of soda, is by roasting with coal the sulphate of soda, produced in retorts in the manufacture of hydrochloric acid. I. P. Gillard, of Paris, has applied for a patent for a process of producing carbonate of soda direct from common salt, as follows :—A certain quantity of salt amounting to a proper charge for the size of retort used, is placed in the retort, then a current of superheated steam, hydrogen and carbonic oxide is passed over it at a high temperature. Under such treatment, he states, the hydrochloric acid is evolved and carried off by the outlet tube, and a mass of carbonate of soda mixed with caustic soda is left in the retort. Common salt is composed of chlorine and sodium. This may be the germ of a great improvement in the manufacturing of soda.

New Reefing Devices.—Several methods have been proposed and tried for reefing and furling topsails, and other square sails from deck, instead of mounting the yards for the purpose. The following method has been patented by I. Medhurst, of London. The yard used for the application of the invention is tubular iron, with a slot or opening in the forside, somewhat exceeding the breadth of the sail at the close reef. A tube or roller is fitted in the center of the hollow part of the yard, which revolves on bearings at the ends. On this roller the sail is laced, and when the yard is lowered the sail is wound up on it. A chain from the deck passes through a sheave in the topmast over the yard, and then round a chain wheel fixed to and above the yard at the slings. The chain then passes over a second sheave on the mast and returns to the deck, so that when the yard is lowered by slacking off one end of the chain, the whole weight of the yard and sail being pendent on the chain, will cause the chain wheel to revolve. This chain wheel puts in motion two axes. These have pinions at their ends, which gear with cog wheels at the ends of the roller to which the sail is attached. As a security against the roller being bent or otherwise damaged by heavy squalls of wind, a broad hook, made of iron, is placed so as to support the middle of the roller. This hook is covered with leather to prevent its damaging the sail, and is connected with a purchase, so that, after the sail has been reefed or when it is set, this hook may be made to take the weight of the center of the roller. Any amount of rotation may be given to the roller which takes up the sail.

Coal-Tar Colors.—The benzole which is obtained by the distillation of the naphtha, obtained from coal tar, is converted into nitro-benzole, by mixing it with nitric acid (aquafortis). It is then impregnated with hydrogen in a nascent state, by adding iron or zinc chips to the nitro-benzole, and pouring into it some sulphuric acid. In this manner aniline is formed, which is the base of those beautiful colors, mauve, magenta and solferino. A patent has been taken out by Francois Laurent and John Casthelaz, of Paris, for an improved method of obtaining such colors. They take twelve parts by weight of nitro-benzole, and add twenty-four parts of fine iron filings, and six parts of concentrated commercial hydrochloric (muriatic) acid. This mixture after being stirred, is allowed to stand for about twenty-four hours without artificial heat being applied. The mass then assumes a resinous appearance and becomes solid, and contains iron, chloride of iron, and what the inventors call erythro-benzine. This is then broken in pieces, and crushed in a mortar, after which it is dissolved in water, and the coloring matter contained in it is precipitated by adding to it common salt. The color thus obtained is again dissolved and precipitated in the same manner, and is ready to be used for dyeing and printing.

RECENT AMERICAN INVENTIONS.

The following are some of the most important improvements for which Letters Patent were issued from the United States Patent Office last week. The claims may be found in the official list :—

Machine for Seaming Sheet Metal.—This invention consists in arranging the bearings of the burring rollers in transversely adjustable slides, in such a manner that said rollers can be readily separated and the machine drawn back without lifting it off the seam; it consists further in the employment of squeezing rollers in combination with the burring, folding and seaming rollers, in such a manner that the working rollers can be released from the seam, while the squeezers hold the machine firmly in its place; it consists further in combining with said squeezing rollers, a yielding bearing and an eccentric cam, in such a manner that by the action of the cam the squeezing rollers can readily be separated and the seam released. It consists, finally, in arranging the wheels which support the machine on eccentric bearings, in such a manner that by turning the axles of the wheels the machine can be adjusted higher or lower as may be desired. C. M. Dowd and W. G. Dowd, of Scranton, Pa., are the inventors of this device.

Cutting Button Holes.—The object of this invention is to obtain a device by which button holes may be very expeditiously cut in tents and in garments and the places also marked where buttons are to be attached. The invention consists in the employment or use of a frame and a series of cutters or awls arranged in such a manner as to effect the desired end. Daniel W. Whitney, of New York city, is the inventor of thir device.

Relieving Slide Valves of Pressure.—This invention relates to transferring a desirable portion of the pressure produced by the steam on the back of the valve, to a series of rollers arranged to run upon tracks within the valve chest. It consists in a certain construction and arrangement of means for adjusting the tracks upon which such rollers run, also in certain means of combining the rollers with the valve and adjusting them relatively thereto. Andrew Buchanan, of Jersey City, N. J., is the inventor of this improvement.

Wagon Axle.—This invention consists in surrounding the axle of a wagon or other vehicle with a case of Babbitt's metal or other suitable composition, said case being provided with a shoulder thick enough to afford room for an oil cup, from which a channel extends through the case on the top of the axle in such a manner, that a self-lubricating axle is produced, the body of which is protected from wear by the surrounding case which, together with the oil cup can be renewed with little trouble, whenever it may be desirable. R. P. Gillett, of Viroqua, Wis., is the inventor of this improvement.

Seaweed in Place of Hair.

It is becoming quite a common practice in this city to use seaweed in place of curled hair for upholstry, cheap furniture and the filling of mattresses. Quite an extensive business is carried on from Long Island in the seaweed line, and vessels often leave the wharves bound for New York freighted with this article of merchandise, where it is sold to upholsters and others, bringing a higher market price than a like quantity of the very best hay. On the shore where this seaweed is gathered, the seaweed is spread out and dried, and then pressed and baled the same as hay. In this condition it is sent to the metropolis, where it is at once converted into hair mattresses, used for sofas, chairs, &c. The best articles of this kind are stuffed with seaweed, hair sufficient being used to conceal the former and avoid detection. This branch of business is now carried on extensively, and the profits accruing therefrom are of no inconsiderable amount.

WHAT IT COSTS TO "READ" THE LONDON "TIMES."—No fewer than twelve individuals are daily employed in what is technically termed "reading" the London *Times*. The chief "proof reader," a gentleman of finished education, receives an editorial salary—but has to forfeit one guinea for every typographical error, even to a turned letter, in a day's impression, but if he has marked the error on the proof, the compositor, who neglected to correct it, pays the forfeit.

ISSUED FROM THE UNITED STATES PATENT OFFICE

FOR THE WEEK ENDING SEPTEMBER 30, 1862.

Reported Officially for the Scientific American.

*** Pamphlets giving full particulars of the mode of applying for patents, under the new law which went into force March 2, 1861, specifying size of model required, and much other information useful to inventors, may be had gratis by addressing MUNN & CO., Publishers of the SCIENTIFIC AMERICAN, New York.

36,553.—Francis Alger, of Boston, Mass., for Improvement in Combined Time and Percussion Fuse for Shells :

I claim, first, The combination in one fuse case or stock, of a charged plunger, and a time percussion fuse.

Second, The apertures, v v, substantially as and for the purpose specified.

Third, The plugged holes, m m, through the sides of the fuse case, for the purpose of transmiting fire to the interior of the shell, substantially as described.

36,554.—William Ballard, of Homer, N. Y., for Improvement in Grain Drills :

I claim the manner of attaching the drills upon a vibrating bar, n, to the adjustable bar, q, and the peculiar construction of said bar, q, with elbowed or crooked ends, and the manner of supporting it by a pivot working in a slot, the whole to be used in combination as above set forth.

36,555.—J. L. Bonham, of Hellen, Pa., for Improvement in Revolving Ordnance :

I claim, first, The combination of the revolving many-chambered cylinder, H, swinging bed, G, and swiveled frame, D, constructed and operated in the manner and for the purposes set forth.

Second, The knife, N, in combination with the cylinder, H, when arranged to operate in the manner and for the purposes set forth.

Third, The combination of the cylinder, H, lever, J, pawl, L, trip, Q, and hammer, P, when arranged to operate in the manner and for the purpose set forth.

36,556.—Andrew Buchanan, of Jersey City, N. J., for Improvement in Valves for Steam Engines :

I claim, first, The employment as ways for the valve rollers to run upon, of bars adjustable by screws, substantially as herein specified.

Second, Combining the roller axles with the valve, by means of recesses, i i, in the bars, I I, or their equivalents, attached rigidly to and projecting over the ends of the valve, substantially as and for the purpose herein specified.

Third, The set screw, j j, applied in combination with the bars, I I, or their equivalents, and the roller axles, substantially as and for the purpose herein specified.

36,557.—A. B. Crosby, of Greene, Maine, and Jesse Ladd, of Boston, Mass., for Improved Machine for Collecting and Amalgamating Fine Particles of Gold :

We claim the application of a perforated plate diaphragm or partition, in the manner above described and for purposes above specified.

36,558.—W. H. Crosby, of Washington, D. C., for Improvement in Boilers for Culinary Purposes :

I claim the slides, E2 E2 E2, operated by the latch, F, when combined with a boiler for culinary purposes, constructed and operating substantially as described.

36,559.—Lyman Derby, of New York City, for Improvement in Attaching Thills to Axles. Antedated Aug. 19, 1862 :

First, I claim the longitudinal arrangement of the bolt, E, with reference to the thills, in combination with the thill irons, B, substantially as described and for the purposes hereinbefore set forth.

Second, I also claim the jack, having a mortise longitudinally through it, in combination with the bolt, E, and the thill irons, B, substantially as described and for the purposes hereinbefore set forth.

Third, I also claim the use of the recess, H, formed in the sides of the mouth of the mortise in the jack, substantially as described and for the purposes hereinbefore set forth.

36,560.—M. L. Dickinson, of West Troy, N. Y., for Improved Whisk Brush :

I claim as a new article of manufacture a whisk brush, constructed of the brush fibers only of broom corn whisks, and a wooden core, C, the broom corn fibers, b, being bound upon the wooden core, and forming the whole outer portion of the handle, I, of the brush, as herein described and shown by the annexed drawings.

36,561.—C. H. and W. G. Dowd, of Scranton, Pa., for Improvement in Machines for Seaming Metal Roofing :

We claim, first, The arrangement of the transversely moving slides, I I', in combination with the burring rollers, D D' E E' F F', constructed and operating substantially as and for the purpose herein shown and described.

Second, The employment of squeezing rollers, I I', in combination with the burring rollers, D D' E E' F F', folding roller, G, and seaming roller, H, all arranged and operating substantially as and for the purpose herein set forth.

Third, The arrangement of the eccentric lever, m, and yielding bearing, l, in combination with the squeezing rollers, I I', as and for the purpose set forth.

Fourth, The employment of axles, C C', which are bent outside the journals, so as to be eccentric to the journals themselves, in combination, with the wheels, B B', and frame, A, as and for the purpose specified.

36,562.—George Earle, of Dover, Ohio, for Improved Process for Forming Leather Straps for Harness, &c. :

I claim the herein described process of forming cylindrical straps for harness and other purposes.

36,563.—J. P. Frazer, of New York City, for Improvement in Fastenings for Chamber Doors :

I claim the adaptation of the hook screw and key, for the uses and purposes herein set forth.

36,564.—R. P. Gillett, of Viroqua, Wis., for Improvement in Wagon Axles :

I claim, having the axle covered with Babbitt's metal, with an oil reservoir made in such metal, all as herein set forth and described.

36,565.—L. W. Hines, G. Saterlee and S. W. Harden, of Quasqueton, Iowa, for Improvement in Grain Registers :

We claim the arrangement of the stops, c d, in combination with the swinging frame, A, spring, C, or its equivalent, spring pawl, D, and ratchet wheel, E, all constructed and operating as and for the purpose herein shown and described.

Also the arrangement of the closed box, B, in combination with the swinging frame, A, spring, C, and with the registering mechanism, as and for the purpose specified.

[The invention consists in the application of two stops, one on either end of a swinging spring lever or frame, one end of which is designed to receive the grain measure, whereas its other end is subjected to the action of a spring or its equivalent, and acts by means of a spring pawl on a ratchet wheel, in such a manner that whenever the measure is filled, and the swinging frame depressed, the action of the spring pawl is sure to propel the ratchet wheel exactly one tooth, and when the measure is emptied, the inner end of said swinging frame descends by the action of the spring just far enough to cause the pawl to catch in a new tooth of the ratchet wheel ready for a new move; it consists further in combining with the swinging frame, a closed box provided with narrow slots through which the side timbers of the frame extend, and arranged so that the same protect the inner end of the swinging frame, together with the spring pawl and registering apparatus, against the injurious influence of the dust which rises during the operation of handling the grain.]

36,566.—W. W. Hubbell, of Philadelphia, Pa., for Improvement in Concussion Fuses for Shells :

I claim, first, The central metallic stem or fracturing tube, surrounded by the burning composition, so that it shall withstand the heat, and part at the fracturing point on concussion.

Second, I claim the head, p, set in the top or front of the metallic stem or tube, so as to fly out of it and expose the central hole in the stem on concussion to explode the shell.

Third, I claim the plaster of Paris lining inside of the metallic stem, for the purpose described.

Fourth, I claim the combined horizontal and vertical vents in the capping; and these also in combination with the conical or accelerating chamber.

Fifth, I claim securing the capping by screwing it or otherwise to the front end of the paper-case fuse, so as to set the fuse readily into any stock, already capped for service when in action.

Sixth, I claim the paper facing surrounding the metallic fracturing stem, to support it, and burn away and release it, substantially as described.

Seventh, I claim the fracturing stem when constructed of sections of metal put together, and operating in the manner and for the purpose substantially as described.

Eighth, I claim the conical or accelerating chamber, l, inside of the water capping, as described.

36,567.—Samuel Keeler and Jacob Barthel, of Lancaster, Pa., for Improvement in Seed Drills :

We claim the combination of the cam, E, attached to the swinging bar, O, with the pivoted lever, A, operating the shut-off slide, the whole constructed, arranged and operating in the manner and for the purpose set forth.

36,568.—G. H. Kidney, of Cleveland, Ohio, for Improved Washing Machine :

I claim, first, The roughened-surfaced, self-adjusting bed plate, when the same is constructed substantially as described, and for the purpose set forth.

Second, I claim the combination of the roughened surfaced, self-adjusting bed plate, and the roughened-surfaced cylinder, when the several parts are constructed and arranged, substantially as described and for the purpose set forth.

36,569.—H. B. Lansing and H. W. Grenell, of Hudson, Mich., for Improvement in Corn Planters :

We claim, first, The markers, e e e, at one end of the axle inserted into the collar, C, and at the other end into the axle, A, for the purpose herein set forth.

Second, We claim the tube, d, in combination with the stamper, Q, operated in the manner and for the purpose herein described.

Third, We claim the jointed lever, K O, in connection with the ratchet wheel, J, and the toothed collar, C, arranged in the manner and for the purpose herein set forth.

35,570.—Rufus M. Merrill, of Chicago, Ill., for Improvement in Lantern Lamps :

I claim, first, The application of one or more air tubes or passages outside the oil cup of a lantern lamp, substantially as and for the purpose herein set forth and described.

Second. The spring catches, D D, when arranged substantially in the manner and for the purpose specified.

36,571.—Myron Moses, of Malone, N. Y., for Improvement in Breech-Loading Firearms :

I claim, first, In combination with the removable charge-holding chamber or cylinder, D, the neck, l, and shoulder near it, on the outside and front end of said chamber or cylinder, and the recess in the bore for receiving both the neck and the shoulder, for the purpose specified.

Second, I claim the movable cup, G, with its opening, 5, in combination with an opening, x, for the passage of the nipple, r, as the barrel is vibrated, and for the escape of gas from the exploded cap, arranged and operating substantially as described.

36,572.—Nelson Palmer, of Greenville, N. Y., for Improvement in Hay Elevators :

I claim the combination of the bale, d, jointed brace, e, and cord, f, with the hay fork, a b c, as and for the purposes specified.

36,573.—G. T. Pearsall, of Apalachine, and S. A. Garrison' of Union, N. Y., for Improved Machine for Boring Hubs :

We claim, first, The securing of wheel, C, to a suplemental frame, B, containing the working parts of the machine, which frame is attached to the fixed frame, A, when the latter is in a horizontal position, as and for the purpose specified.

Second, The nut, E, provided with an external spherical case, j*, of soft metal cast around it, in connection with the spherical socket, j, formed in or between the plates, f k, the case, j*, and nut, E, being prevented from turning in the socket, j, by a projection, K', substantially as herein set forth.

Third, The disk or head, H, formed of the two plates, o p, fitted in the plate, c, of the frame, C', in connection with the slide, I, screw, D, and nut, E, all arranged for joint operation, as and for the purpose herein set forth.

[This invention relates to a new and improved machine for boring the hubs of carriage wheels to receive their boxes. The object of the invention is to obtain a machine for the purpose specified which will perform the work expeditiously and in a perfect manner, and with a greater or less taper, as may be required.]

36,574.—C. B. Reichmann, of New York City, for Improvement in Holders for Lamp Shades :

I claim the lips, 4 4, and slots, 3 3, formed as specified, and employed for connecting the spring, c, to the ring, b, in the manner and for the purposes set forth.

36,575.—J. S. Rowell and M. F. Louth, of Beaver Dam, Wis., for Improvement in Horse Powers :

I claim the described arrangement of the master wheel, B b, pinion shafts, D D', cog wheel, F, internal gear wheel, G, tumbling shaft, H, and pinions, I I', the whole construcied and operating in the manner and for the purposes specified.

[This invention entirely dispenses with the necessity for friction rollers, which with horse powers having bevel gears running at a high speed, are usually required to hold the said wheels in gear.]

36,576.—J. P. Schenkl, of Boston, Mass., for Improvement in Percussion Fuses for Explosive Shell :

I claim the construction of the rear end of the plunger case, A, in such manner that the said rear end, while the fuse may be fixed in a shell, shall separate the plunger chamber, c, from the powder charge of the shell, and on explosion of the charge of the plunger, be broken away thereby, so as to allow the flame of such explosion to communicate with the explosive charge of the shell.

I also claim the concussion fuse, as made with an explosive charge arranged within its plunger, and to be fired by explosion of the cap or percussion powder of the nipple, such being for the purpose of setting fire to the bursting charge of the shell, as described.

36,577.—F. B. Scott, of Buffalo, N. Y., for Improvement in Rotary Pumps :

I claim, first, The arrangement of the piston cylinder, F, pistons, J, and cam, D, with the case, A, substantially as herein set forth.

Second, The hollow rotary shaft, P, in combination with the water chamber, S, substantially as described.

36,578.—John Sebo, of Wilmington, Del., for Improvement in Invalid Bedsteads :

I claim the shape of the rails, D, and their arrangement and combination with the devices, E G and J, arranged and combined as described, for the purposes set forth.

36,579.—B. C. Smith, of Burlington, N. J., for Improvement in Railways :

I claim, first, combining a series of longitudinal cast-iron girders, A, secured to each other and bedded into the ground, with a series of detachable rails, B, substantially as set forth for the purpose specified.

Second, The brackets, C and C', the latter being either fixed or loose, and the wedge, D, the whole being combined with and applied to the girder and rails, substantially as set forth.

Third, The projections, E and E', on the girder, A, in combination with the rail, B, and detachable wedge-formed blocks, F, the whole being arranged substantially as and for the purpose set forth.

Fourth, Securing the adjacent beams to each other by means of the straps, H, applied to the projections, G G, and secured thereto by lips, h, and key, I, substantially as specified.

Fifth, Connecting the tie rod, K, to the beams, by confining the head in a recess formed between projections, G G, as specified.

36,580.—J. J. Storer and J. D. Whelpley, of Boston, Mass., for Improvement in Grinding Mills :

We claim, first, A triturator, having a disk, F, and a central outlet, K, in combination with a fan or blower, I, for producing currents from the rim toward the central outlet, to carry off the dust or fine powder as it is produced, substantially as specified.

Second, We claim the strikers, M, with a thin edge, n, in advance, substantially as set forth.

Third, We claim the chambers or recesses, u, on the inner face of the rim, f, for the purpose specified.

Fourth, We claim, in combination with a mill or triturator for producing fine dust or powder, and a fan or blower for carrying along the dust or powder, a collecting chamber or box, P, covered or partially covered with a suitable cloth, which will permit the escape of the air, whilst it retains the dust or powder, substantially as set forth.

36,581.—M. D. Whipple, of Cambridge, Mass., for Improvement in Water Gages for Steam Boilers :

I claim, first, Using the lower part of the working cylinder itself as a stove or fire pot, in combination with an air pump and passage for conveying and forcing the air from below up through the fire directly against the piston, substantially as described and for the purpose set forth.

I also claim in combination with a divided cylinder a long hollow piston fitting loosely in that part of the cylinder which is exposed to the direct action of the fire, and packed at its other end which is so far removed from the direct action of the fire that the packing will not be destroyed by it, substantially as set forth and described.

I also claim facing the end of the piston which is in immediate contact with the fire by a disk of soapstone or its equivalent, substantially as described.

I also claim, in combination with a hopper and the fire pot of a hot-air engine an automatic feed worked from the engine and supplying the fire intermittently with fuel, substantially in the manner set forth.

I also claim, in combination with the fire or gas chamber of a hot air engine an explosive valve, G, for the purpose described.

36,582.—James K. Whiteside, of Rising Sun, Md., for Improved Washing Machine :

I claim, in combination with the wash box, and washing block or frame, the ribs, E d e, arranged to operate in connection with each other in the manner substantially and for the purpose set forth.

36,583.—W. F. Cochrane (assignor to himself and Warder and Child), of Springfield, Ohio, for Improvement in Hopper Boys for Flour Mills :

I claim, first, Giving to the spout or trough which feeds the meal from the cooling floor to the bolting reel, a free vertical movement, so that its mouth may always maintain the same relative position to the surface of the meal on the cooling floor.

Second, The combination of the rake-arm, B', with the spout-arm, B2, and sliding spouts, B3, substantially in the manner described.

Third, Making the arm which carries the sliding spout thin in its horizontal cross section, and sharp or wedge-shaped on its under side, for the purpose herein described.

36,584.—J. B. Greene (assignor to E. P. Gleason), of Providence, R. I., for Heater for Lamp Chimneys :

I claim, as a new article of manufacture, the within-described heater for lamp chimneys, whether attached to the vessel or object to be heated, or distinct and separate therefrom as set forth.

36,585.—Isaac Hicks (assignor to himself and L. E. Peck), of Hartford, Wis., for Improvement in Stump Extractors :

I claim the combination of the bar, B, levers, C F, one or both, lifting bar, D, and fulcrum supporting bar, E, all arranged to operate as and for the purpose herein set forth.

I further claim the applying of the wheels, G G, to the frame, A, of the machine, through the medium of the levers, K K, and hooks, L L, arranged with the axle, H, and sill pieces, a a, of the frame, as and for the purpose herein specified.

[The object of this invention is to obtain a simple and efficient device for extracting stumps from the earth, one that may be operated with facility, and readily moved from place to place in order to be applied to its work.]

36,586.—Jacob Jenkins, of Lynn, Mass., assignor to G. W. Keene, M. W. Shepard, and J. C. Stimpson, of Salem, Mass., for Improvement in Machines for Preparing Heels for Boots and Shoes :

I claim, first, The cams, V' and 16, in combination with the slides, I J K and L, and the tool stock, 24, constructed and operated as and for the purposes described.

Second, The combination of the adjustable crank, C, the arm, D, and the chains, E E', with the rotating pattern block, G, constructed and operated substantially as described.

Third, The tool-stock, 24, constructed as described, in combination with the arms, N and M, substantially as above set forth.

36,587.—C. H. Paine, of Providence, R. I., assignor to himself and Howard Tilden, of Philadelphia, Pa., for Improvement in Carriage Jacks :

I claim the new or improved arrangement substantially as described of the bars, A B, and the levers, C D.

Also the combination and arrangement of the toggle or link, F, with the levers, C D, and their supporting frame, the whole being made to operate as explained.

36,588.—Eli Perry (assignor to himself and John Boley), of Baldwinsville, N. Y., for Improvement in Rotary Pumps :

I claim the combination with the spiral discharge passage, D, of the piston provided with curved concave wings, E E, and the feeder, G, the whole arranged and operating substantially as and for the purpose herein set forth.

36,589.—Philander Perry, of Waterford, N. Y., assignor to himself and E. H. Bender, of Albany, N. Y., for Improvement in Wipers for Blackboards :

I claim the combination of the wooden blocks, A and D, with a covering of cloth, the space between them being filled with a stuffing composed of prepared shavings, and clippings of cloth, with or without pieces of sponge, substantially as described and for the purposes set forth in the within specification.

36,590.—R. N. Eagle, of New York City, for Improvement in Snuffers for Lamps :

I claim, first, The making of the blades of snuffers or snuffing shears for lamps, constructed with chimneys or without, and burning flat or round wick, either concave or convex, to meet the convexity or concavity of the burner or tube holding the wick.

Second, So constructing lamp snuffers for trimming the round wick that the indentation in one or both blades, when the latter are opened, admits the wick, and, in closing, encircles and compresses it and accomplishes the work in a single and even cut in the manner described.

Third, Making snuffers or snuffing shears for lamps with one part of the blades straight and another part concave or convex, for the purposes set forth.

Fourth, A partial gallery or a circular raised rim for catching the crust or burnt part of the wick when removed,

36,591.—John N. Wilkins, of Chicago, Ill., for Improvement in Sewing Machines :

I claim, in combination with the rotating hook, eye-pointed needle and spool, the thread controller having the mode of operation, substantially such as herein described, to receive the loop and hold it from the face of the spool so that that portion of the loop which extends back of the hook shall be drawn over the edge to the front thereof, before the point of the hook reaches the needle to enter the next

loop, the said controller being so inclined as to permit the loop freely to escape from it as it is drawn up in forming the next loop, as set forth.

And I also claim extending the said loop controller to or near the edge of the spool, substantially as described, to prevent the loop from getting into the spool, as set forth.

36,552.—John B. Atwater, of Ripon, Wis., for Improvement in the Rifling of Guns :

I claim the cutting out of each land, in the manner and for the purpose herein specified.

36,593.—T. R. Timby, of Worcester, Mass., for Improvement in Revolving Battery Tower. Antedated July 8, 1862 :

I claim a revolving tower for defensive and offensive warfare, whether placed on land or water.

36,594.—D. W. Whitney, of New York City, for Improvement in Apparatus for Piercing Cloth for Button Holes. Antedated Aug. 23, 1862 :

I claim the combination and arrangement of a series of perforators with a frame and platform, arranged substantially as and for the purpose herein set forth.

EXTENSION.

3,840.—David Dick, of Meadville, Pa., for Improvement in Presses :

I claim the combination of two eccentric sectors having their bearings upon edges, as set forth above, with a roller placed between them, whose axis has free play, all in the manner and for the purpose above set forth.

Notes and Queries

L. J. J., of Iowa.—It is a very common practice, and it is generally considered to be the best method, to put the cogs on the two rims of an overshot wheel and take off the power at a point opposite to where the water is producing the greatest effect upon the wheel. For burr stones 36 inches in diameter you may run them at the rate of 140 revolutions per minute, and you should proportion your gearing relatively with the velocity of the wheel to give them this speed.

J. B. A., of N. Y.—The gunboat *Essex* is coated with plates only one inch in thickness. Her india-rubber lining is also only one inch in thickness. The resistance of this boat to the penetration of shot and shell, as described in Commodore's Porter's report, is surprising. If, as you state, 1-inch plating and a lining of india rubber resist shot in a superior manner to 4½-inch plates, it is folly to use the thick plating on the new gunboats in this city. We have not been informed of the thickness of plating to be employed on the gunboats now being built at Pittsburgh.

J. W. C., of Honolulu.—Hot-air engines are manufactured by Wilcox, Denison and Taylor, of Westerly, R. I., also by J. B Kitching (Ericsson's), No. 164 Duane street, this city. An Ericsson engine of 24-inch cylinder is 4½-horse power ; cost $750 ; a 2½-horse power costs $550. If any part of these engines gets out of order it can be duplicated.

S. H., of N. J.—The best cement known to us for a leaky tin roof, consists of sand and dry chalk in equal parts mixed with white or red lead, moistened with linseed oil. This cement becomes very hard and yet it possesses sufficient elasticity to accommodate itself to the expansion and contraction of the metal without cracking.

H. B. W., of Pa.—Sulphuric acid is used in large quantities for cleaning iron castings, when such castings are required to be scoured bright. It is the cheapest acid which can be used for such a purpose. About a pint of acid to ten of water is a very good strength of pickle for steeping the castings in.

T. G., of Del.—Our best bituminous coal contains about 80 per cent of carbon and one pound of it requires 265 cubic feet of air for its combustion. Anthracite coal contains about 92 per cent of carbon, and requires about 282 cubic feet of air for the perfect combustion of one pound. It is only the oxygen which is in atmospheric air that combines with the carbon of coal during combustion; the nitrogen of the air is inert. If oxygen alone were supplied during combustion the heat would be more intense, because much of the caloric in a furnace is dissipated in heating the nitrogen of the air. A cheap method of supplying oxygen to furnaces would be a great acquisition to those who are engaged in smelting metals.

A. S., of N. Y.—If you desire to enter the naval school you must apply to your member of Congress.

S. G. M., of Pa.—Your steam refrigerator seems to possess some novel features, and we think a patent could be obtained for it. We have forwarded you the necessary instructions by mail.

J. W. H., of Iowa.—Your cane juice evaporator seems to be a very good one and we regard it as new and patentable.

H. F., of Ohio.—In performing ordinary work a circular saw 30 inches in diameter and making 270 revolutions per minute will saw 40 square feet of oak per hour to 1-horse power, and 70 square feet of spruce. The feed of a log should always be proportional to the hardness of the timber to be sawed.

S. J. T., of Minn.—It requires about 1-horse power to grind 100 pounds of fine wheat flour per hour. One run of burr stones 4 feet in diameter and running at the rate of 120 revolutions per minute will grind five bushels of wheat per hour. Of course the stones must be kept in good condition.

A. P., of N. Y.—We have not seen a signal lantern like yours and are of opinion that a patent may be obtained for it. If you decide to proceed with the matter please send us a model with the first government fee ($15) and we will take the case in hands at once. Do not forget to give us your full name.

H. C. J., of Conn.—Numerous remedies have been proposed for toothache. You will find one described by one of our correspondents on page 120, Vol. VII. (old series.) It consists of two parts, by weight, of brown sugar ; two of tar ; one of fine black pepper, all mixed together cold and applied to the affected part. Our correspondent stated that it is to be applied occasionally for a day or two, when a perfect cure will be effected. He had tried it twice with success upon himself and some of his neighbors had also found it to be equally efficacious. The remedy is simple, not dangerous, and you may try it ; but as there are various causes for toothache, of course, that which may arrest pain in one case will not in another. "Show me the root of the evil" was the remedy propounded by a witty dentist for toothache. He thus earned his fee.

A. L., of Pa.—We do not know the color "Parma Violet by that name. In all likelihood it is the mauve, or aniline purple.

O. C., of Ohio.—In order to render the color of your hair perfectly black and remove its refreshing red shade, you must use a stronger solution of the nitrate of silver and add a little gum arabic to it with aqua-ammonia. It should be put on at night and allowed to become perfectly dry before you wash it. It should also have full exposure to the light, as it is by the action of light it is rendered black.

A. S., of N. Y.—The cement used for filling holes in iron consists of sal-ammoniac in powder, 2 ounces ; flowers of sulphur, 1 ounce ; fine iron borings, 50 ounces made into a paste with water. It is filled into the holes as soon as made up, and then allowed to dry. No cement whatever however, can fill up holes in cast iron castings that will answer as well as the solid metal ; but by the receipt we have given you can make the common cement used for cracks in iron plates, and also for open joints. Make up the exact quantity you wish to use and no more as it sets fast and becomes hard.

J. B. J., of N. Y.—There is an evening mechanical drawing school over the Apprentices' Library, No. 472 Broadway.

G. E. B., of Ind.—Dana's Mineralogy stands decidedly at the head of all treatises on that subject. If you have a good teacher Davies's algebra is a very profound work ; if you wish to study without a teacher we recommend Loomis's. We are advised by Henry M. Parkhurst, who is perhaps the ablest short hand reporter in the country, that the best work on Stenography is Benjamin Pittman's published in Cincinnati.

P. C., of Me.—If at the time of making application for your patent you made oath through mistake that you were a citizen of the United States, your patent when issued would be void. The Commissioner of patents has no power to reissue a patent under such circumstances. Such a mistake does not fall within the designation "defective or insufficient description or specification."

M. H. G., of Maine.—Friction grooved gearing consists in principle of two broad-faced pulleys, the one having V-grooves in it and the other wedge-shaped rings, or projections meshing into the opposite grooves.

H. F. W., of N. Y.—Petroleum received its name from being first discovered oozing from certain rocks. It is found in the Kanawha valley, Virginia; the Alleghany valley in Pennsylvania; near Hinsdale in New York ; in Canada West and various other localities on our continent. It was known many years ago under the name of Seneca and Indian oil, and was employed in its crude state as a lotion for cutaneous eruptions, and as an embrocation in bruises and rheumatic affections. Petroleum is used both for fuel and light by the inhabitants of Batku on the Caspian. Its utility as fuel has already been set forth in our columns.

H. L. R., of N. Y.—Cast steel is cast in molds in making axes and plows at Collinsville, Conn., and in Newark, N. J., for making small hatchets, &c. To make small articles of cutlery, such as knives, scissors, &c., by casting steel, they should also be hammered after being cast, to make them tough and more close in the grain.

C. G. P., of Indiana.—Common putty mixed with white lead and pulverized dry sand makes an excellent cement for cracks in timber exposed to water. Common pitch applied hot is also a good cement for the purpose in situations not exposed to the sun. Melted resin and brick dust mixed together is used by plumbers for a cement. They sometimes add a little tallow to it. We can furnish you with blank assignments at 6 cents each.

L. J. McD., of Conn.—Most of the ingot tin used in the United States comes from the Island of Banca in the East Indies. Cornwall in England has been celebrated for over two thousand years for its tin mines, from which about 5,000 tuns are still obtained annually. Tin veins can be profitably worked when only 3 inches wide. Metallic tin is obtained from the ores by smelting it in a crucible with pulverized charcoal and a small quantity of borax.

Money Received

At the Scientific American Office on account of Patent Office business, from Wednesday, October 1, to Wednesday, October 8.

K. & H., of Wis., $20; H. B. B., of Mass., $20; D. M. A., of Me., $20; J. C. G., of Mass., $45; D. H., of Ill., $20; C. S. D., of N. Y., $20; B. T. B., of N. Y., $40; N. S. H., of Mo., $20; C. B., of N. Y., $43; A. B., of N. J., $43; R. P. P., of N. Y., $46; G. H. H., of England, $70, J. B., of Ky., $20; W. H. L., of Ind., $20; J. D., of Mich., $20; H. H. C., of Mich., $20; J. W., of Iowa, $20; A. R., o Cal., $20; J. E. K., of N. Y., $45; P. & R., of England, $20; R. & G., of Pa., $20; J. A. U., of Iowa, $45; W. H. W., of N. J., $20; M. G.

of Cal., $15; E. B., of Ill., $20; T. & E. of Pa., $15; T. C. F., of N. Y., $15; J. H., of Ill., $35; S. N. T., of N. Y., $25; I. C. C., of Mich., $15; A. G. E., of Mass., $25; J. W. F., of Pa., $25; A. S., of Kansas, $25; W. C. S., of N. Y., $25; P. J. L., of N. Y., $15; H. A. A., of Ill., $15; S. & H., of N. J., $15; T. V., of Cal., $100; F. N., of Conn., $12; O. J. S., of N. Y., $10; J. F. H., of Mich., $15; D. T., of Mass., $13; J. C. C., of Mass., $15; J. L. S., of Ind., $12; J. W. B., of Cal., $10; J. C. M., of Conn., $15; R. C. R., of N. J., $120; G. H., of N. Y., $35; E. V. L., of N. Y., $15; G. J., of N. Y., $15; R. W. C., of N. Y., $15; R. H. J., of Ill., $25; U. P., of Conn., $15; H. H. C., of N. Y., $25; A. B., of N. Y., $25; W. S. E., of N. Y., $25; S. R. D., of Mass., $25.

Persons having remitted money to this office will please to examine the above list to see that their initials appear in it, and if they have not received an acknowledgment by mail, and their initials are not to be found in this list, they will please notify us immediately, and inform us the amount, and how it was sent, whether by mail or express.

Specifications and drawings and models belonging to parties with the following initials have been forwarded to the Patent Office from October 1, to Wednesday, October 8, 1862:—

G. B. O., of N. Y.; B. T. B., of N. Y.; C. B., of N. Y.; A. B., of N. J.; R. P. P., of N. Y.; J. W. F., of Pa.; L. D. G., of N. Y.; W. C. S., of N. Y.; S. N. T., of N. Y.; A. B. S., of Pa.; A. G. E., of Mass.; S. R. D., of Mass.; W. S. E., of N. Y.; G. B. B., of Ind.; A. S., of Kansas; R. H. J., of Ill.; T. & H., of Mass.; G. H., of N. Y.; F. N., of Conn.; J. L. S., of Ind.; O. J. S., of N. Y.; A. B., of Conn.

TO OUR READERS.

RECEIPTS.—When money is paid at the office for subscriptions, a receipt for it will always be given; but when subscribers remit their money by mail, they may consider the arrival of the first paper a *bona fide* acknowledgment of our reception of their funds.

INVARIABLE RULE.—It is an established rule of this office to stop sending the paper when the time for which it was pre-paid has expired.

Models are required to accompany applications for Patents under the new law, the same as formerly, except on design patents when two good drawings are all that is required to accompany the petition, specification and oath, except the government fee.

PATENT CLAIMS.—Persons desiring the claim of any invention which has been patented within thirty years, can obtain a copy by addressing a note to this office, stating the name of the patentee and date of patent, when known, and inclosing $1 as fee for copying. We can also furnish a sketch of any patented machine issued since 1853, to accompany the claim, on receipt of $2. Address MUNN & CO., Patent Solicitors, No. 37 Park Row, New York.

NEW PAMPHLETS IN GERMAN.—We have just issued a revised edition of our pamphlet of *Instructions to Inventors*, containing a digest of the fees required under the new Patent Law, &c., printed in the German language, which persons can have gratis upon application at this office. Address MUNN & CO., No. 37 Park-row, New York.

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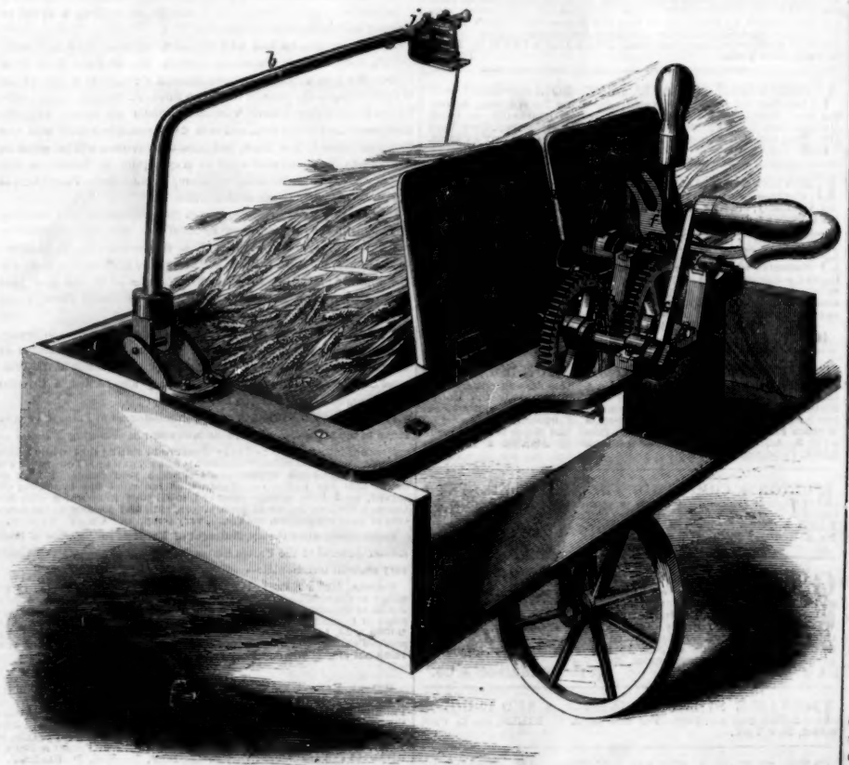
Improved Grain Binder.

The binding of grain into sheaves in the field would seem to be one of the last operations to be attempted by means of mechanism, but the inventors of the binder here illustrated assert that it was used last harvest by the patentees, with entire success, binding with ease all the grain that can be cut with any reaper, and with one half the expense of any other method as it requires but three men to perform all the labor.

This binder is designed to be attached to a reaping machine, from which it receives the grain, wrapping each sheaf with a band of strong twine, and turning off the grain in bundles as fast as it is cut by the reaper.



POWERS AND LANCASTER'S GRAIN BINDER.

The twine, wound on a spool and deposited in a box at the side of the frame, is led along the groove in the revolving head, *a*, as shown, and attached to the head of the swinging arm, *b*. As the workman throws this arm over backward, the twine is stretched across the concave bed, C, so that when the grain is raked upon this bed from the harvester, the twine will be stretched under the grain. The workman now swings the arm, *b*, forward, bringing the twine over the bundle, thus completely encircling it. As the head of the arm, *b*, descends, it carries the twine down the slot, *d*, in the hinged board, E, and the head of the arm, *b*, comes directly upon the rotating head, *a*, thus bringing the two ends of the band together. The parts are so adjusted in relation to each other that this motion draws the band quite tightly around the bundle. The workman now grasps the handle of the lever, *f*, the forked end of which embraces the arm, *b*, and raising the handle of this lever, forces both ends of the thread between the transverse plates of the head, *a;* the plates on the end of the arm, *b*, being provided to perform this office. One of the plates on the arm, *b*, has a sharp edge by which the cord is cut at the same time that it is pressed among the plates of the head, *a*. The arm, *b*, is then thrown up, and the workman grasps the handle of the crank, G, and turns this crank through half of a revolution. This movement, through the medium of a train of gearing, imparts a rapid rotary motion to the head, *a*, by which the ends of the band are twisted very firmly together, when they are cut off by bringing forward the knife, *h*, which has a handle, I, for moving it on its fulcrum.

As the plates on the end of the arm are forced between those on the rotating head, *a*, a small stud on the head presses the twine between the elastic jaws, *j*, at the end of the arm, which hold the end of the twine and carry it again across the bed, C, as the arm is swung back for the next bundle.

The ends of the string are so forcibly twisted together, that when they are cut, in the endeavor to untwist by the elasticity of the twine, they are drawn partly under the band; thus securing the knot very firmly from giving way.

The inventors say that this binder will pay for the expense of binding in the amount of grain saved, as all the grain that is thrashed out in the binding process is saved on the binder.

A patent for this invention was granted, through the Scientific American Patent Agency, October 29, 1861, and measures have been taken to secure certain modifications embraced in this description. Further information in relation to the matter may be obtained by addressing the inventors, Charles Powers and P. Lancaster, at Bronson, Mich.

The New Metal Thallium.

This new metal, which was discovered by Mr. William Crookes, of London, has lately been described by the discoverer in the *Chemical News*, and preparations of it have been placed in the Great Exhibition. Thallium, in most of its physical properties, resembles lead. It is not so white as silver, but when freshly cut, it presents a brilliant metallic luster. It is soft, malleable and easily cut with a knife, and it marks paper when rubbed upon it, leaving a yellowish streak. It has a great tendency to crystallize, and ingots of it crackle like those of tin when bent. To flame it communicates a deep green color; and in the spectrum, according to the researches of M. M. Bunson and Kirchoff, its single green ray is as sharply defined as the yellow ray of sodium. Thallium rapidly tarnishes in the open air, and it becomes covered with a thin pellicle of oxide, which, like the oxide of tin, preserves the rest of the metal from oxidization. Its oxide is soluble, alkaline in its nature, and it has a taste and smell similar to potash. Sulphuric and nitric acids dissolve it under heat, and it burns in chlorine gas heated to 200°. It exists in many of the pyrites that are used in the manufacture of sulphuric acid.

To ascertain whether an egg is good or bad, hold it up to the light. A good egg is translucent, but a bad one is perfectly opaque; the difference is as easily perceived as that between a blue egg and a white one.

Measurement of the Great Lakes.

The Government survey of the great lakes, gives the following exact measurements:—Lake Superior—greatest length 355 miles, greatest breadth 160 miles, mean depth 988 feet, hight above the sea 627 feet, area 32,000 square miles. Lake Michigan—greatest length 360 miles, greatest breadth 108 miles, mean depth 900 feet, hight above the sea 587 feet, area 20,000 square miles. Lake Huron—greatest length 200 miles, greatest breadth 160 miles, mean depth 300 feet, hight above the sea 574 feet, area 20,000 miles. Lake Erie—greatest length 250 miles, greatest breadth 80 miles, mean depth 200 feet, hight above the sea 262 feet, area 6,000 miles. Lake Ontario—length 180 miles, mean breadth 65 miles, mean depth 500 feet, hight above the sea 262 feet, area 6,000 square miles. Total length of five lakes—1,345 miles; total area—83,000 square miles.

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